

國立臺灣大學 期中 考試答案卷

National Taiwan University Midterm/Final Examination Answer Sheet

記分	教師簽名或蓋章
93	

課程編號

Course no.

科目

Course title

考試日期

Date

從此處開始寫起。試卷用紙務須節用。非經主試認可不得續用其他紙張作答。

Please write from here.

靜力學

工

學院 機械

學系

Department

組

Division

年級

Year

99 年 11 月 16 日

學號

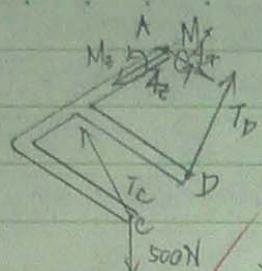
Student ID no. 899502011

姓名

楊傑

記分欄

1. (a)



$$b) \hat{d} = -\frac{4}{5}\hat{i} + \frac{3}{5}\hat{j} \quad \hat{DE} = \frac{4}{5}\hat{j} - \frac{3}{5}\hat{k}$$

$$\Sigma F = 0 : \begin{cases} Ax - \frac{4}{5}T_c = 0 \\ \frac{3}{5}T_c + \frac{4}{5}T_D - 500N = 0 \\ Az - \frac{3}{5}T_D = 0 \end{cases}$$

$$\Sigma M_A = 0 : \vec{AC} \times (\vec{T}_c - 500N\hat{j}) + \vec{AD} \times \vec{T}_D + M_x\hat{i} + M_z\hat{k} = 0$$

$$\Rightarrow [(80mm)\hat{i} + (135mm)\hat{k}] \times [-\frac{4}{5}T_c\hat{i} + \frac{3}{5}T_c\hat{j} - 500N\hat{j}] + [(80mm)\hat{i} + (90mm)\hat{k}] \times [\frac{4}{5}T_D\hat{j} - \frac{3}{5}T_D\hat{k}] + M_x\hat{i} + M_z\hat{k} = 0$$

$$\Rightarrow \begin{cases} -(87mm)T_c + (135mm)(500N) - (72mm)T_D + M_x = 0 \\ -(108mm)T_c + (48mm)T_D = 0 \\ (48mm)T_c - (80mm)(500N) + (64mm)T_D + M_z = 0 \end{cases}$$

$$3T_c + 4T_D - 2500N = 0$$

$$9T_c - 4T_D = 0$$

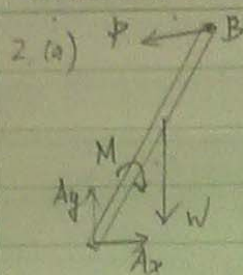
$$\Rightarrow \begin{cases} T_c = 208N \\ T_D = 469N \end{cases}$$

$$c) Ax = \frac{4}{5}T_c = 167N$$

$$Az = \frac{3}{5}T_D = 281N$$

$$M_x = ? \quad -16.884$$

$$M_z = ? \quad 0$$

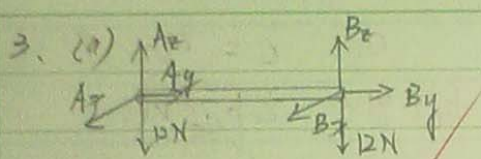


$$(b) W \times \frac{L}{2} \sin \theta + M = P \times L \sin 45^\circ$$

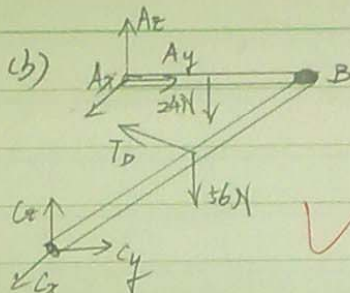
$$\Rightarrow W L \sin \theta + 2M = \sqrt{2} P L$$

$$(c) P = \frac{W \sin \theta}{\sqrt{2}} + \frac{2M}{\sqrt{2}L} = \frac{(20N) \times \frac{1}{2}}{\sqrt{2}} + \frac{650 N \cdot cm}{\sqrt{2} \times 15cm} = 68.35 N$$

22 (a) $A_x = P \sin(45^\circ + 30^\circ) = 36.4 N$
 $A_y = P \cos(45^\circ + 30^\circ) + W = 37.69 N$



Yes, it is a two-force member.



(c) 對 A 軸求合力矩為 0 $\vec{CD} = \sqrt{40}\hat{i} + 3\hat{j}$, $\vec{T}_D = T_D \left(\frac{\sqrt{40}}{\sqrt{40+9}}\hat{i} - \frac{3}{\sqrt{40+9}}\hat{j} + \frac{4}{\sqrt{40+9}}\hat{k} \right)$
 $(\vec{CD} \times \vec{T}_D) \cdot \hat{i} + (\vec{CD} \times (-56N)\hat{k}) \cdot \hat{i} + (\vec{CA} \times (-12N)\hat{k}) \cdot \hat{i} + (\vec{CB} \times (-12N)\hat{k}) \cdot \hat{i} = 0$

$$[(-\sqrt{40}\hat{i} + 3\hat{j}) \times (\frac{\sqrt{40}}{\sqrt{40+9}}T_D\hat{i} - \frac{3}{\sqrt{40+9}}T_D\hat{j} + \frac{4}{\sqrt{40+9}}T_D\hat{k})] \cdot \hat{i} + [(3\hat{j}) \times (-24N)\hat{k}] \cdot \hat{i} = 0$$

$$\Rightarrow \frac{4}{\sqrt{40+9}}T_D = 80 \Rightarrow T_D = 161 N$$

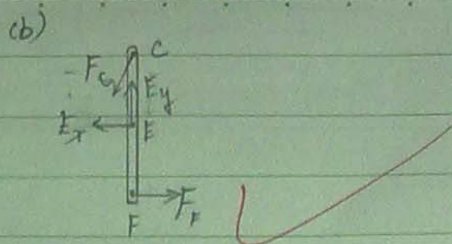
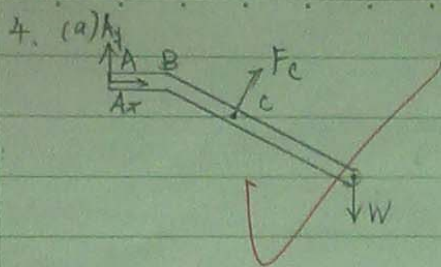
23 (a) $\Sigma F = 0$: $A_x + C_x + \frac{\sqrt{40}}{\sqrt{40+9}}T_D = 0$
 $A_y + C_y - \frac{3}{\sqrt{40+9}}T_D = 0$
 $A_z + C_z = 0$

$$\Sigma M_A = 0: (-\sqrt{160}m)\hat{i} \times (A_x\hat{i} + A_y\hat{j} + A_z\hat{k}) + [(-\sqrt{40}m)\hat{i} + (3m)\hat{j}] \times T_D \left(\frac{\sqrt{40}}{\sqrt{40+9}}\hat{i} - \frac{3}{\sqrt{40+9}}\hat{j} + \frac{4}{\sqrt{40+9}}\hat{k} \right) + [(-2\sqrt{40}m)\hat{i} + (3m)\hat{j}] \times (-24N)\hat{k} = 0$$

承上小題 $\Rightarrow \begin{cases} (\sqrt{160}m)A_z + (\sqrt{40}m)(\frac{4}{\sqrt{40+9}}T_D - 56N) + (2\sqrt{40}m)(-24N) = 0 \\ (-\sqrt{160}m)A_y + \frac{3\sqrt{40}}{\sqrt{40+9}}T_D - \frac{3}{\sqrt{40+9}}T_D = 0 \end{cases}$

$$\Rightarrow \begin{cases} A_x + C_x + \frac{\sqrt{40}}{\sqrt{40+9}}T_D = 0 \\ A_y = 0, C_y = 60 N \\ A_z = 12 N, C_z = -12 N \end{cases}$$

(d) $B_x = -A_x = 0$ 已知 two force member $A_x = B_x$ 自然是 0
 $B_y = -A_y = 0 N$
 $B_z = 24 - A_z = 12 N$



(c) $A_x + F \sin \theta = 0$

$A_y + F \cos \theta - W = 0$

$-(L+3L \cos \theta)W + (L+2L \cos \theta)F \cos \theta + 2L \sin \theta F \sin \theta = 0$

$F(L \cos \theta + L \cos^2 \theta + 2L \sin^2 \theta) = W(L+3L \cos \theta)$

$\Rightarrow F = W \left(\frac{1+3 \cos \theta}{\cos \theta + \cos^2 \theta + 2 \sin^2 \theta} \right)$

(d)

$A_x = -F \sin \theta$

$A_y = W - F \cos \theta$

(e) $F_f - E_x - F \sin \theta = 0$

$\Rightarrow E_x = 2F \sin \theta$

$E_y = F \cos \theta$

$\Rightarrow E_y = F \cos \theta$

$2L F_x = 2L E_x$

(f) compression

F_f 是正值