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الميكانيك
Polytechnic
اجنة

لجنة الميكانيك - الإتجاه الإسلامي

Al-Balqa' Applied University Faculty of Engineering Department of Road and Bridge Engineering	
رقم الطالب :	20
وقت المحاضرات :	د. فاروق مرقية

Statics Second Exam - 5th May 2014

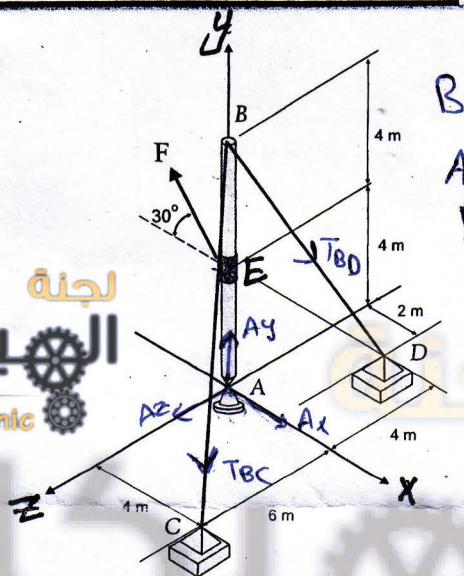
Exam time: 50 minutes

ANSWER ALL QUESTIONS -WRITE YOUR FINAL ANSWERS ON THIS PAPER-

-SHOW YOUR CALCULATIONS ON THE ANSWER SHEET- Final answers with no solution will get **ZERO**

Q1- The flag mast AB shown is supported by a ball and socket support at A and by cables from point B to points C and D.

The mast is subjected to force $F = 200$ N that acts in the middle of the mast. F is in the xy plane and the direction of F make 30° with an axis parallel to y axis. Given that the member AB is in equilibrium, determine the tension in the cables: (10 marks)



10
 $B(0, 8, 0)$
 $A(0, 0, 0)$
 $E(0, 4, 0)$
 $C(4, 0, 6)$
 $D(2, 0, -4)$

1.1- $T_c = 133.2443634$

1.2- $T_D = 170.08321$

$$\vec{T}_{BD} = T_{BD} \hat{u}_{BD} = T_{BD} \left(\frac{\vec{r}_{BD}}{|\vec{r}_{BD}|} \right) = T_{BD} \left(\frac{2i - 8j - 4k}{\sqrt{4 + 64 + 16}} \right) = T_{BD} \left(\frac{2i - 8j - 4k}{9.16515} \right)$$

$$\vec{T}_{BD} = 0.21822 T_{BD} \hat{i} - 0.87287 T_{BD} \hat{j} - 0.436436 T_{BD} \hat{k} \quad N$$

$$\vec{T}_{BC} = T_{BC} \hat{u}_{BC} = T_{BC} \left(\frac{\vec{r}_{BC}}{|\vec{r}_{BC}|} \right) = T_{BC} \left(\frac{4i - 8j + 6k}{\sqrt{16 + 64 + 36}} \right) = T_{BC} \left(\frac{4i - 8j + 6k}{10.77} \right)$$

$$\vec{T}_{BC} = 0.3714 T_{BC} \hat{i} - 0.7428 T_{BC} \hat{j} + 0.5571 T_{BC} \hat{k} \quad N$$

$$\vec{F} = -200 \cos 30^\circ \hat{i} + 200 \sin 30^\circ \hat{j}$$

$$\vec{F} = -173.205 \hat{i} + 100 \hat{j} \quad N$$



لجنة الميكانيك - الإتجاه الإسلامي

$$M_A = \{r \times F = (\vec{r}_{AE} \times \vec{F}) + (\vec{r}_{AB} \times \vec{T}_{DB}) + (\vec{r}_{AB} \times \vec{T}_{CB}) = 0$$

$$= (\vec{r}_{AE} \times \vec{F}) + \vec{r}_{AB} \times (\vec{T}_{DB} + \vec{T}_{CB}) = 0$$

$$\vec{r}_{AE} = 4\hat{j}$$

$$\vec{r}_{AB} = 8\hat{j}$$

$$\begin{array}{ccc|c} \hat{i} & \hat{j} & \hat{k} & \\ \hline 0 & 4 & 0 & \\ \hline -173.205 & 100 & 0 & \end{array} + \begin{array}{ccc|c} \hat{i} & \hat{j} & \hat{k} & \\ \hline 0 & 8 & 0 & \\ \hline 0.21822 T_{DB} + 0.374 T_{CB} & & & \end{array} \left\{ \begin{array}{l} -0.87287 T_{DB} \\ -0.7428 T_{CB} \end{array} \right\} \left\{ \begin{array}{l} -0.436436 T_{DB} \\ +0.5571 T_{CB} \end{array} \right\} = 0$$

$$\sum M_x = 0 \quad (8 \times (-0.436436 T_{DB} + 0.5571 T_{CB})) = 0$$

$$-3.491488 T_{DB} + 4.4568 T_{CB} = 0$$

$$T_{CB} = \frac{3.491488 T_{DB}}{4.4568} \quad \checkmark$$

$$\sum M_y = 0$$

$$\sum M_z = 0 \quad (692.82 - 1.74576 T_{DB} - 2.9712 T_{CB}) = 0$$

$$692.82 - 1.74576 T_{DB} - 2.9712 \left(\frac{3.491488 T_{DB}}{4.4568} \right) = 0$$

$$692.82 - 1.74576 T_{DB} - 2.327658 T_{DB} = 0$$

$$-4.073418 T_{DB} = -692.82$$

$$T_{DB} = 170.08321 \quad \checkmark \quad N$$

$$T_{CB} = 133.2443634 \quad \checkmark \quad N$$

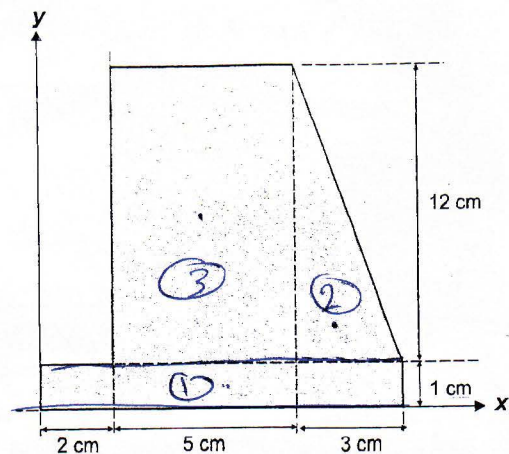
Note $T_{DB} \equiv T_D$ / $T_{CB} \equiv T_C$ \neq



لجنة الميكانيك - الإتجاه الإسلامي

Q2- Given the shaded area shown, determine the x and y coordinates of the centroid: (10 marks)

\bar{x} (cm)	\bar{y} (cm)
5.2727	5.5117636 5.852272



$$\Sigma A = 1 \times 10 + 12 \times 3 \times \frac{1}{2} + 5 \times 12 = 88 \text{ cm}^2$$

$$\Sigma A\bar{x} = 1 \times 10 \times 5 + \frac{1}{2} \times 12 \times 3 \times 8 + 5 \times 12 \times 4.5$$

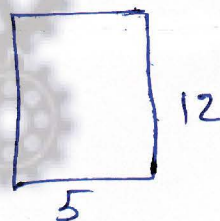
$$\Sigma A\bar{x} = 464 \text{ cm}^3$$

$$\Sigma A\bar{y} = 1 \times 10 \times 0.5 + \frac{1}{2} \times 12 \times 3 \times 5 + 5 \times 12 \times 7$$

$$\Sigma A\bar{y} = 515 \text{ cm}^3$$

$$\bar{x} = \frac{\Sigma A\bar{x}}{\Sigma A} = \frac{464}{88} = 5.2727 \text{ cm}$$

$$\bar{y} = \frac{\Sigma A\bar{y}}{\Sigma A} = \frac{515}{88} = 5.852272 \text{ cm}$$

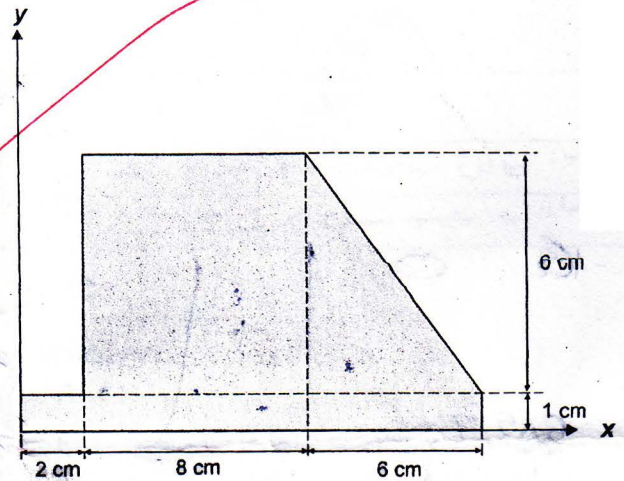


لجنة الميكانيك - الإتجاه الإسلامي

Q2- Given the shaded area shown, determine the x and y coordinates of the centroid:

(10 marks)

\bar{X} (cm)	\bar{Y} (cm)
7.707	3.098



	A	\bar{x}	\bar{y}	$A\bar{x}$	$A\bar{y}$
①	16	8	0.5	128	8
②	$8 \times 6 = 48$	6	4	288	192
③	$\frac{1}{2} \times 6 \times 6 = 18$	12	3	216	54
	<u>82</u>			<u>632</u>	<u>254</u>

$$x = \frac{632}{82} = 7.707$$

$$y = \frac{254}{82} = 3.098$$

لجنة الميكانيك - الإتجاه الإسلامي

Al-Balqa' Applied University
Faculty of Engineering
Department of Road and Bridge Engineering

رقم الطالب :

إسم الطالب :

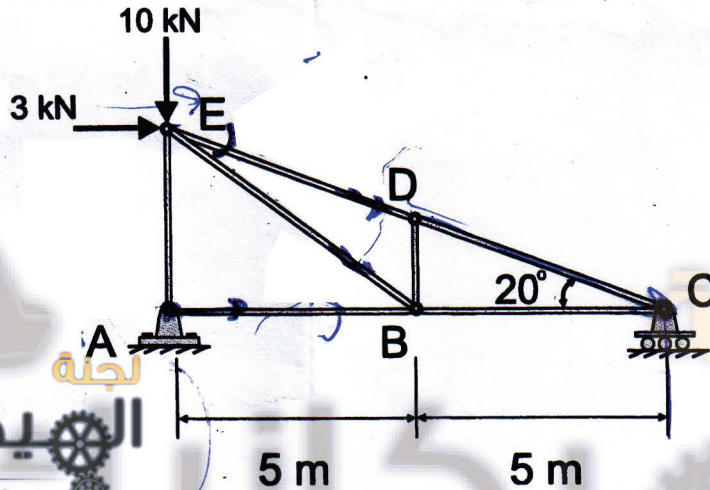
وقت المحاضرات :

مدرس الشعبة :

Statics

-Second Exam- 20th July 2013

J Answer All Questions and Show Your Calculations Clearly
Write down your final answers on empty dot lines



Q1- For the truss subjected to the shown forces, support A is a hinge and support C is a roller. Determine the following internal forces and indicate if Tension (T) or compression (C): (10 marks)

1.1- N_{AB} is ...

1.2- N_{EB} is ...

1.3- N_{ED} is ...



لجنة الميكانيك - الإتجاه الإسلامي

Al-Balqa' Applied University
Faculty of Engineering
Department of Road and Bridge Engineering

رقم الطالب :

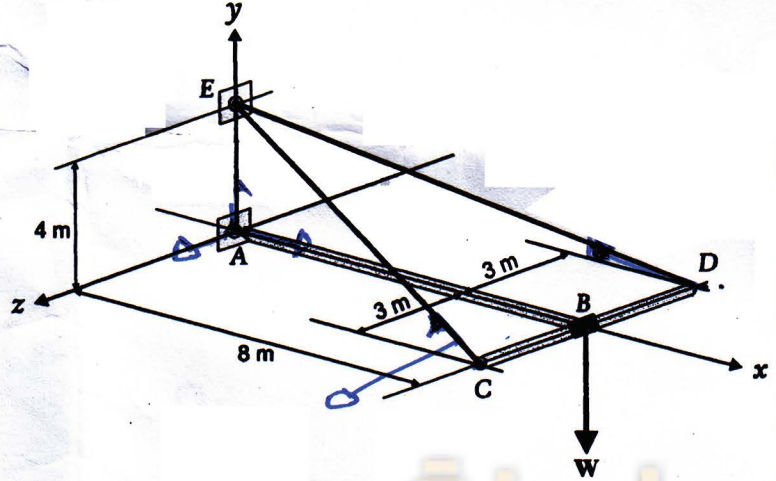
اسم الطالب

وقت المحاضرات : ١١:١٥ - ١٢:١٥

مدرس الشعبة : د. محمد الزحوب

Q2- The rigid body shown is loaded by weight $W=1000\text{ N}$ at B, and it is supported by the ball and socket support at A and cables CE and DE. Determine the magnitude of the tension in cables CE and DE.

(10 marks)



2.1- T_{CE} is ...

2.2- T_{DE} is ..

Polytechnic

لجنة الميكانيك - الإتجاه الإسلامي

Al-Balqa' Applied University Faculty of Engineering Department of Road and Bridge Engineering	رقم الطالب :	اسم الطالب :
	وقت المحاضرات :	مدرس الشعبة :
202 12-1		د. عبد الهادي

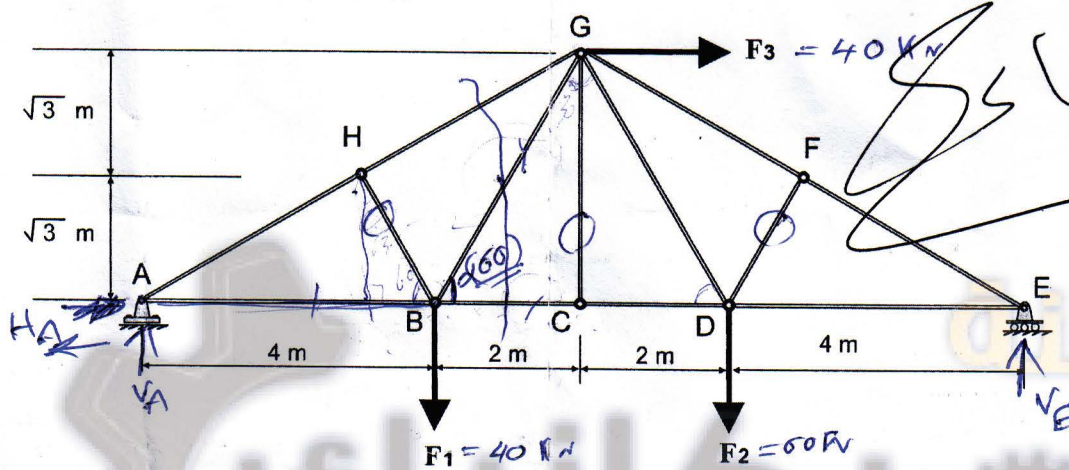
Static Second Exam- Exam Time: 50 minutes

- 10th December 2012 -

Answer All Questions and Show Your Calculations Clearly on the Additional A4 Paper

Write down your final answers on this paper

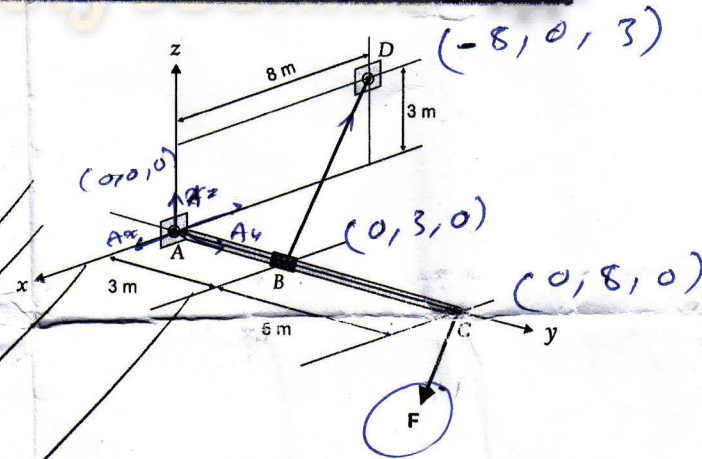
ملاحظة مهمة: يجب تسليم كراس الحل و ورقة الامتحان معا



Q1- The above truss is subjected to forces: $F_1 = 40 \text{ kN}$, $F_2 = 60 \text{ kN}$, $F_3 = 40 \text{ kN}$. Given that support A is a hinge and support E is a roller. Determine the following and indicate if Tension (T) or compression (C): (10 marks)

- 1.1- The vertical reaction at A is: $(13.5 \dots 12 \text{ kN } \uparrow)$ 1.2- The force in member AB is: $(100 \dots 8.284 \text{ kN Tension})$
 1.3- The force in member BG is: $(4.6 \dots 18.8 \text{ kN Tension})$ 1.4- The zero force members are: (F_{HB}, F_{GC}, F_{DF})
 1.5- The force in member BC is: $(7.7 \dots 7.344 \text{ kN Tension})$

Q2- The boom ABC is supported by the ball and socket support at A, and the cable BD. Force F is acting at end C. Given that $F = (18 \mathbf{i} - 6.75 \mathbf{j}) \text{ N}$, determine the tension in cable BD and reactions at the support A (ignore the weight of the boom): (10 marks)



- 2.1- T_{BD} is $(54 \dots 32.245 \text{ kN})$
 2.2- A_x is (30 kN)
 2.3- A_y is (1.8 kN)
 2.3- A_z is (-11.25 kN)

(change the direction)



لجنة الميكانيك - الإتجاه الإسلامي

Al-Balqa' Applied University Faculty of Engineering Department of Road and Bridge Engineering	
رقم الطالب :	إسم الطالب :
وقت المحاضرات :	مدرس للشيبة :

Statics

-Second Exam- 23rd April 2011

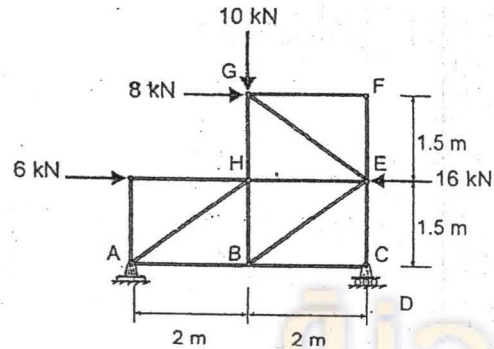
1- Answer all questions and show your calculations clearly and in details on the additional A4 paper.

2- A Final answer without a solution will get **NO** marks

ملاحظه مهمة: يجب تسليم كراس الحل مع ورقة الامتحان معاً بعد نقل الأجوبه النهائية إلى الأماكن المخصصة على ورقة الامتحان

Q1- For the truss subjected to the shown forces, the internal force in member GF is:

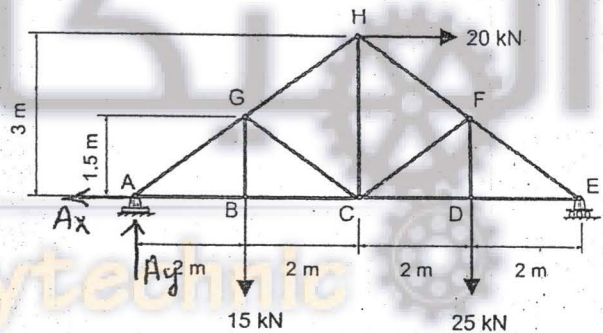
F_{GF} : ... **Zero member** (3 marks)



Q2- For the truss subjected to the shown forces, the horizontal and vertical components of the reaction at A are:

$A_x = 20 \text{ kN}$, $A_y = 10 \text{ kN}$ (3 marks)

$$-A_y \cdot 8 + 15 \cdot 6 + 25 \cdot 2 - 20 \cdot 3 = 0$$



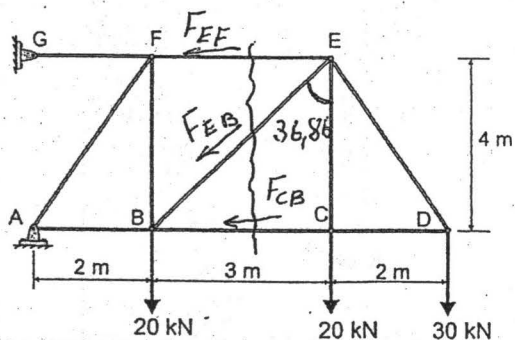
Q3- For the truss subjected to the shown forces, the internal force in member BE is:

F_{BE} : ... **62,5. Compression** (3 marks)

$$\sum F_{iy} = 0 \uparrow \text{ (right part)}$$

$$-20 - 30 - F_{EB} \cdot \cos 36,86 = 0$$

$$F_{EB} = -62,5 \text{ kN Compression}$$



لجنة الميكانيك - الإتجاه الإسلامي

Al-Balqa' Applied University Faculty of Engineering Department of Road and Bridge Engineering	
رقم الطالب :	إسم الطالب :
وقت المحاضرات :	مدرس الشعبة :

Statics

-Second Exam- 23rd April 2011

1- Answer all questions and show your calculations clearly and in details on the additional A4 paper.

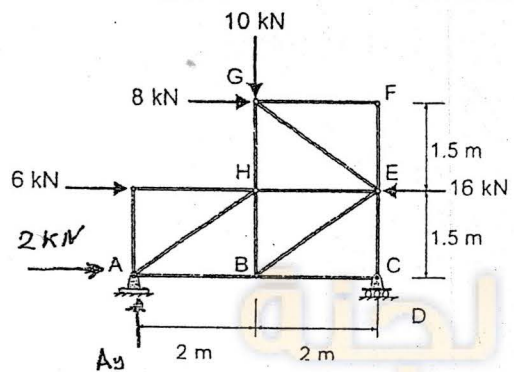
2- A Final answer without a solution will get NO marks

ملاحظة مهمة: يجب تسليم كراس الحل مع ورقة الامتحان معاً بعد نقل الأجوبة النهائية إلى الأماكن المخصصة على ورقة الامتحان

Q1- For the truss subjected to the shown forces, the horizontal and vertical components of the reaction at A are:

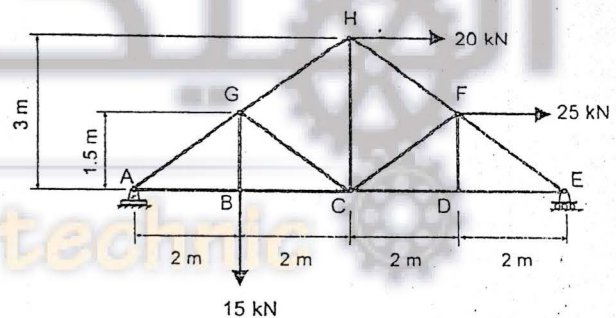
$A_x = 2 \text{ kN}$, $A_y = 2.75 \text{ kN} \uparrow$ (3 marks)

$$-A_y \cdot 4 - 6 \cdot 1.5 - 8 \cdot 3 + 10 \cdot 2 + 16 \cdot 1.5 = 0$$



Q2- For the truss subjected to the shown forces, the internal force in member FD is:

$F_{FD} = \text{Zero member}$ (3 marks)



Q3- For the truss subjected to the shown forces, the internal force in member FC is:

$F_{FC} = 62.149 \text{ kN Tension}$ (3 marks)

$$\sum F_{iy} = 0 \uparrow$$

$$-20 - 30 + F_{FC} \cdot \cos 36.86 = 0$$

