UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2022/2023

COURSE NAME	:	STATIC AND DYNAMIC
COURSE CODE	:	DAC 11803
PROGRAMME CODE	:	DAA
EXAMINATION DATE	:	FEBRUARY 2023
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS
		2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK.**
		3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **NINE (9)** PAGES

Q1   (a)   Vector is physical quantities that requires both magnitude and direction whereas scalar only has magnitude. Based on this statement, determine whether the following is a Vector or Scalar.

       (i)   Mass

       (ii)   Force

       (iii)   Moment

       (iv)   Time

[4 marks]

   (b)   A 6.5 lbs sack of bean is hang as shown in **Figure Q1(b)**. In order to keep the system in equilibrium, determine the following; *[1kg = 2.205 lbs]*
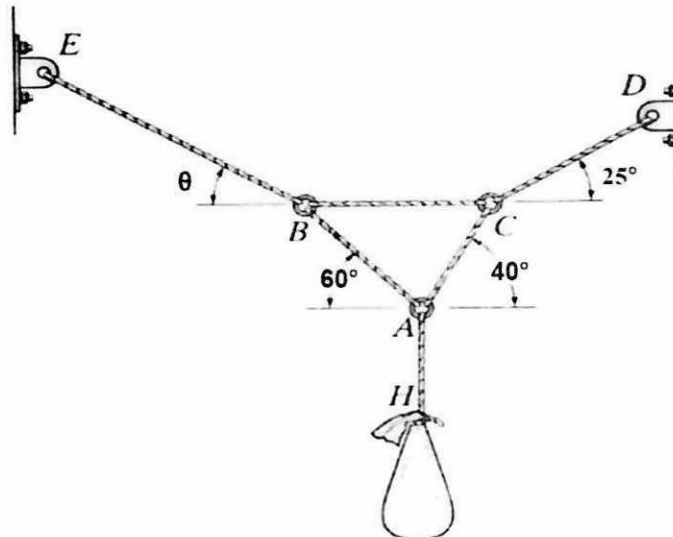

Figure Q1(b)

       (i)   Break down the free body diagram for point A, B and C.

[6 marks]

       (ii)   The force in each rope.

[10 marks]

       (iii)   If the length of rope EB is 2.5m, determine its length if it is transformed to x-axis.

[2 marks]

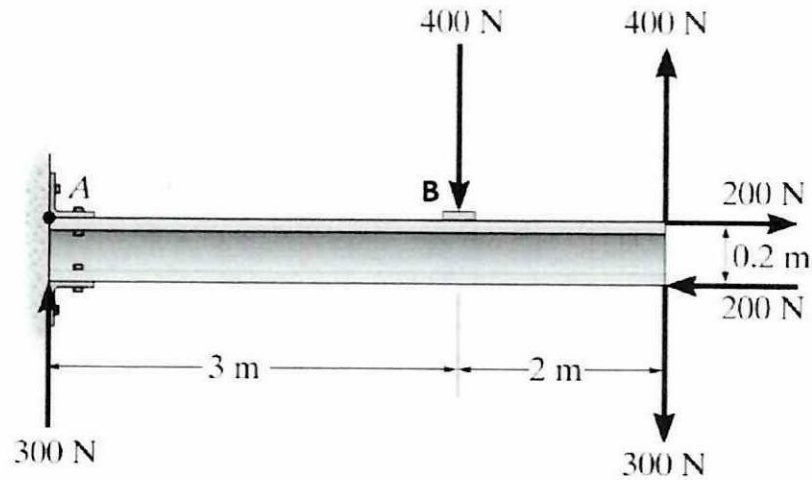(c)   By referring to **Figure Q1(c)**, a cantilever beam is subjected to three force couple. Determine;

Figure Q1(c)

(i)   The resultant couple moment acting on point A.

[1.5 marks]

(ii) The total moment acting on point B.

[1.5 marks]

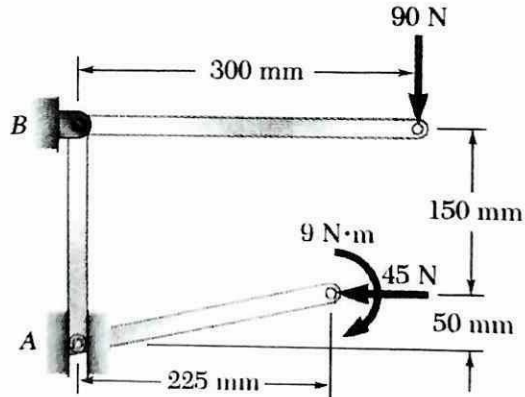**Q2**   (a)   **Figure Q2(a)** shows a steel rod is bend to form a mounting bracket.

Figure Q2(a)

(i)   Draw the free body diagram for the rigid body.

[4 marks]

(ii)   Write force equations of equilibrium for the rigid body.

[4 marks]

(iii)   Determine the reactions at A and B.

[4 marks]

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(b)   **Figure Q2(b)** shows a support block (12kg) is acted upon by two forces. Knowing that the coefficients of friction between the block and the incline are $\mu_s = 0.22$.
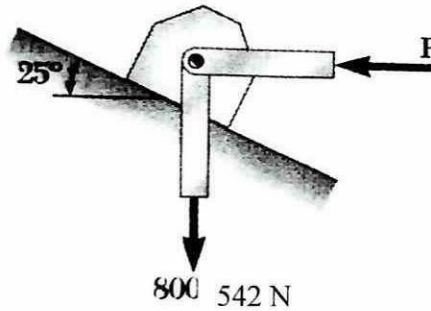

Figure Q2(b)

(i)   Draw the free body diagram of the system complete with magnitudes and direction of forces.

[5 marks]

(ii)   Write all relevant equations of equilibrium for the system.

[4 marks]

(iii)   Calculate the force P for which motion of the block up the incline is impending.

[4 marks]

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Q3 (a) Differentiate center of gravity and centroid of a body.

[4 marks]

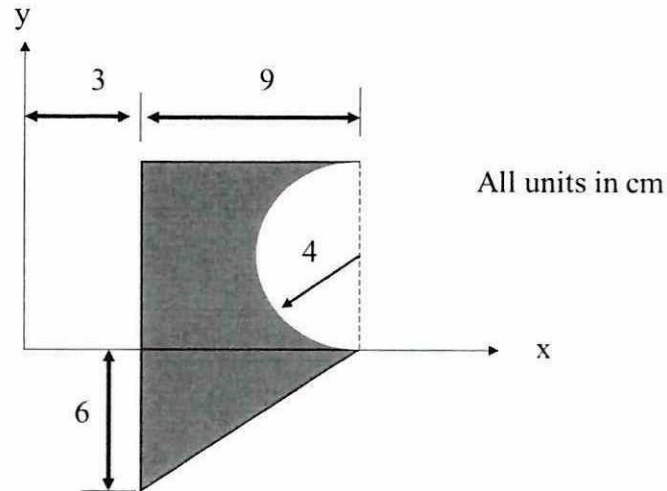(b) Determine the centroid of shaded area shown in the **Figure Q3(b)**.

Figure Q3(b)

[13 marks]

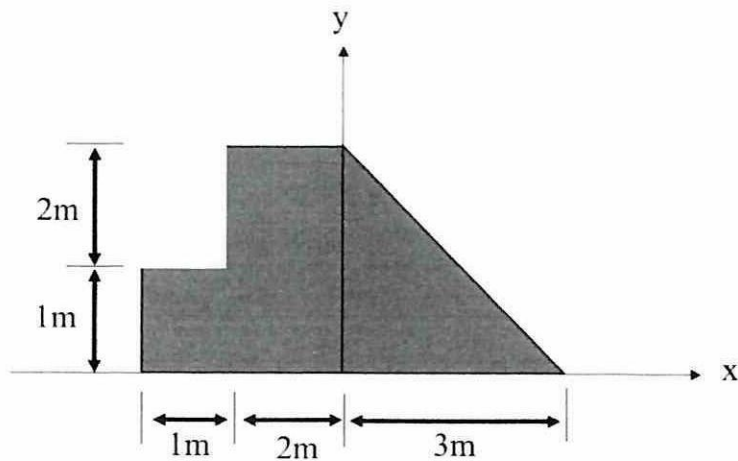(c) Locate the centroid $\bar{y}$ of the plate area shown in **Figure Q3(c)**.

Figure Q3(c)

[8 marks]

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Q4 (a) Briefly explain terminology of Displacement and then list the differences between Displacement and Distance.

[3 marks]

(b) **Figure Q4(b)** shows a shaded composite area. Based on this figure, calculate the moment of inertia of the area about the x-axis.
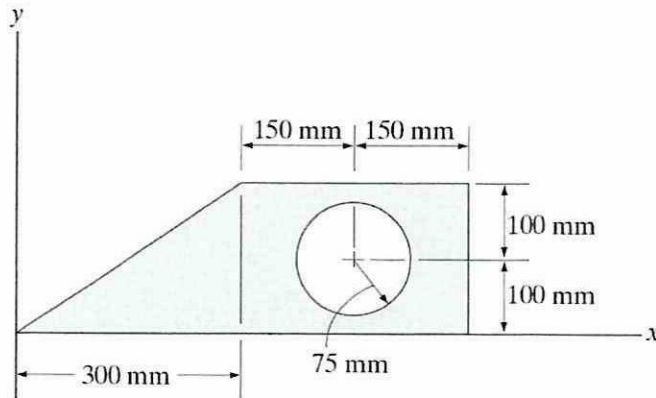

Figure Q4(b)

[7 marks]

(c) A stone is thrown upwards from the horizontal ground with a speed of 14.7 m/s. Assuming that there is no air resistance and taking $g = 9.8$ ms^{-2}.

(i) Determine the time taken for the stone to reach the ground again.

[5 marks]

(ii) Determine the maximum height the stone can reached.

[4 marks]

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(d)   A man pulls a 50kg box as shown in **Figure Q4(d)**. He needs a force 3 times the weight of the box to keep the box moving.
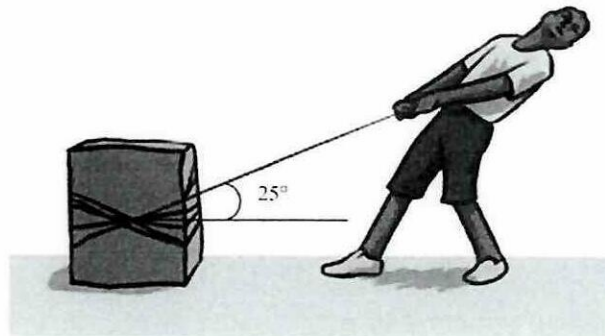

Figure Q4(d)

(i)   Determine the force needed for the man to move the box.

[3 marks]

(ii)   Calculate the work been done if the box was moved in 4m.

[3 marks]

-END OF QUESTIONS-

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FINAL EXAMINATION

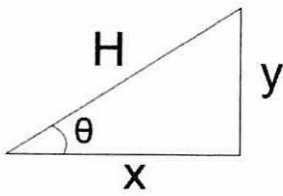SEMESTER / SESSION   : SEM I 2022/2023 .   PROGRAMME CODE : DAA
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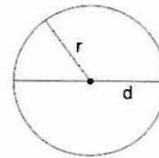
$$\sum F_x = 0 \quad ; \quad \sum F_y = 0 \quad ; \quad \sum F_z = 0 \quad ; \quad \sum M = 0 \qquad M = F \cdot d$$

$$\sin\theta = \frac{y}{H}$$

$$\cos\theta = \frac{x}{H}$$

$$\tan\theta = \frac{y}{x}$$

$$Area = \pi r^2$$

$$I_x = \bar{I}_x + A d_y^2$$

$$I_y = \bar{I}_y + A d_x^2$$

$$J_o = \bar{J}_c + A d^2$$

$$k_x = \sqrt{\frac{I_x}{A}}$$

$$F_s = \mu_s N$$

$$\bar{x} = \frac{\sum_{i=1}^{n} \tilde{x} A}{\sum_{i=1}^{n} A} \quad ; \quad \bar{y} = \frac{\sum_{i=1}^{n} \tilde{y} A}{\sum_{i=1}^{n} A}$$

$$I_{xx} Circle = \frac{\pi r^4}{4}$$

$$I_{xx} Triangle = \frac{bh^3}{36}$$

$$I_{xx} Rectangular = \frac{bh^3}{12}$$

2D Centroid

Shape	$\tilde{x}$	$\tilde{y}$	Area
Quarter semicircular	$\dfrac{4r}{3\pi}$	$\dfrac{4r}{3\pi}$	$\dfrac{\pi \cdot r^2}{4}$
Semi-circular	0	$\dfrac{4r}{3\pi}$	$\dfrac{\pi \cdot r^2}{2}$

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