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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2014/2015**

COURSE NAME : STATICS AND DYNAMICS
COURSE CODE : BFC 10103
**PROGRAMME : BACHELOR OF CIVIL
ENGINEERING WITH HONOURS**
EXAMINATION DATE : JUNE 2015/JULY 2015
DURATION : 3 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

THIS QUESTION PAPER CONSISTS OF NINE (9) PAGES

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- Q1** (a) Define the differences between mass and weight. (5 marks)
- (b) Loads P and Q are hanged on the rope as shown in the **FIGURE Q1(a)**. When this system is in equilibrium, the force in rope 1 is 1500 N and the force in rope 2 is 500 N. Calculate the resultant force in rope 3, 4 and angle θ and α . (10 marks)
- (c) **FIGURE Q1(b)** represents concurrent force system acting at the joint of a bridge truss. Determine the value of P and F to maintain equilibrium of the forces. (10 marks)
- Q2** (a) Define moment of forces and couples, and discuss the example application for both in real life. (6 mark)
- (b) The beam shown in **FIGURE Q2** is subjected to several forces. Determine the value of force P such that the resultant couple moment of the two couples acting on the beam is 900 Nm clockwise (ignore reaction at supports). (10marks)
- (c) If the structure in **FIGURE Q2** is an equilibrium and supported by pin at A and roller at E, using the value of P obtained in **Q2(b)**, calculate the force reaction of the structure. (9 marks)
- Q3** (a) Define moment of inertia and its application. (6 marks)
- (b) Determine the centroid of the shaded area as shown in **FIGURE Q3** and draw the centroid location by using sketch diagram. (8 marks)
- (c) Compute the moment of inertia about the x-axis and y-axis of the shaded area. (11 marks)

- Q4**
- (a) Explain briefly **THREE (3)** types of rigid body planar motion. (6 marks)
- (b) A brick is falling down freely from rest condition at height of 35 meter. Determine the time taken to reach the earth and its velocity at that moment. (9 marks)
- (c) A backhoe weigh 6.5 tonnes moves on the road (no slope) with a constant velocity of 10 km/hour and a total of 600 N friction force is applied on it.
- (i) Determine the pulling power of the engine. (4 marks)
- (ii) Determine the engine power required to push the backhoe at the velocity of 12km/hour if the backhoe ride up the hill with 3° slope as shown in **FIGURE Q4**. (6 marks)

- END OF QUESTION -

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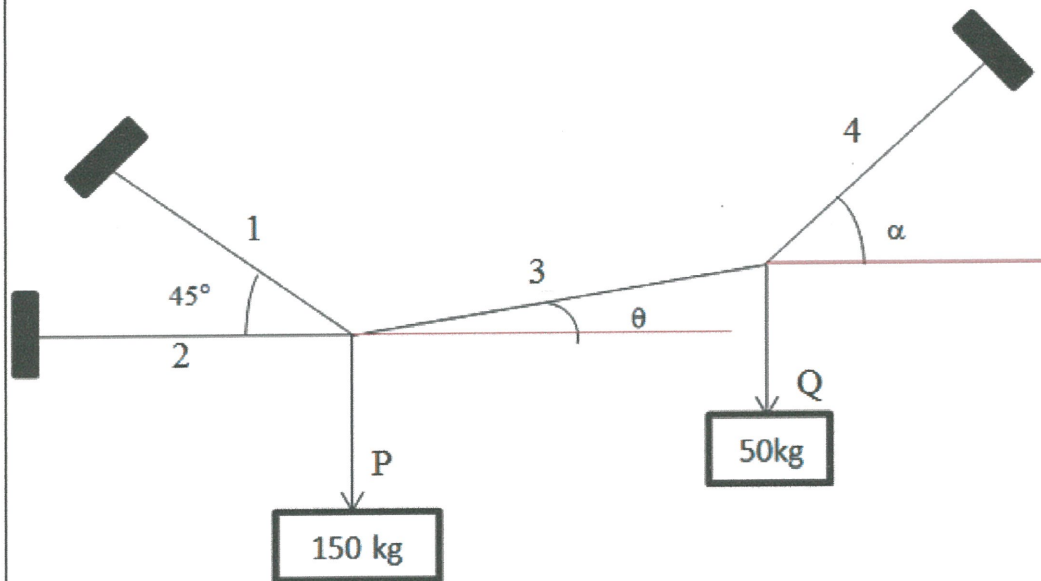


FIGURE Q1(a)

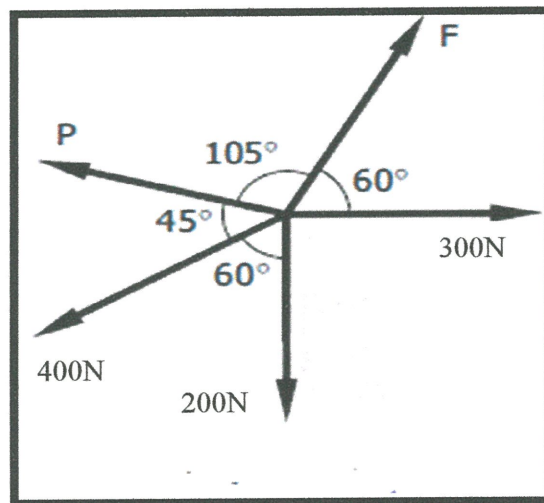


FIGURE Q1(b)

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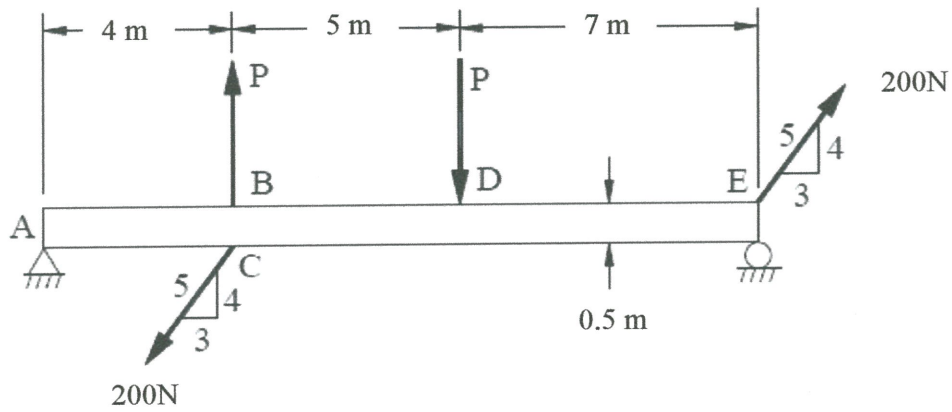
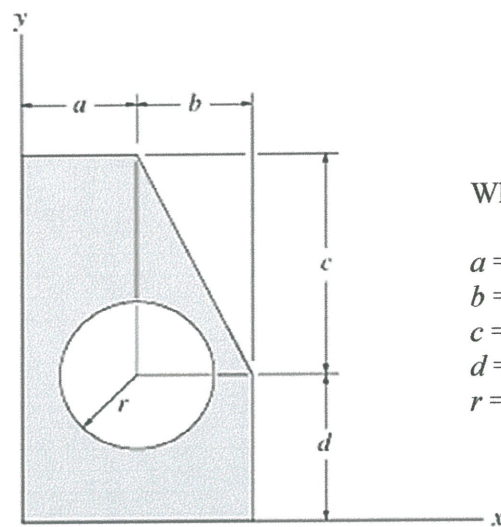


FIGURE Q2



Where;

- $a = 100\text{mm}$
- $b = 100\text{mm}$
- $c = 150\text{mm}$
- $d = 120\text{mm}$
- $r = 50\text{mm}$

FIGURE Q3

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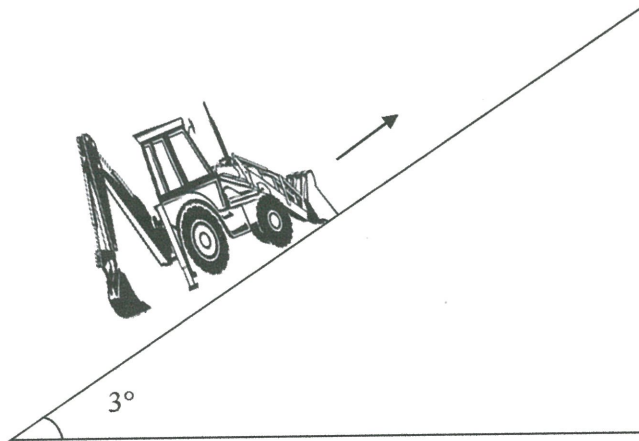


FIGURE Q4



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APPENDIX

TABLE 1 : Centroid

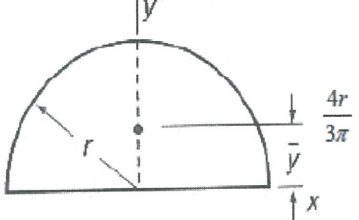
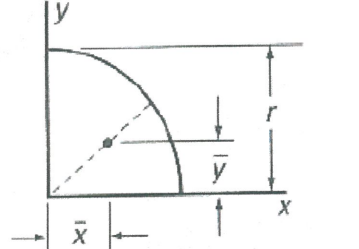
	SHAPE	\bar{x}	\bar{y}	A
Triangle		$\frac{b}{3}$	$\frac{h}{3}$	$\frac{1}{2}bh$
Semicircle		0	$\frac{4r}{3\pi}$	$\frac{\pi r^2}{2}$
Quarter circle		$\frac{4r}{3\pi}$	$\frac{4r}{3\pi}$	$\frac{\pi r^2}{4}$

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TABLE 2 : Moment of Inertia

<p>Semicircle</p>		$I_x = I_y = \frac{1}{8} \pi r^4$ $J = \frac{1}{4} \pi r^4$
<p>Quarter circle</p>		$I_x = I_y = \frac{1}{16} \pi r^4$ $J = \frac{1}{8} \pi r^4$

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LIST OF EQUATION

$$s = v_0 t + \frac{1}{2} a t^2$$

$$v = v_0 + a t$$

$$v^2 = v_0^2 + 2 a s$$

Hooke's Law

$$U = \frac{1}{2} F x \quad @ \quad \frac{1}{2} F s$$

$$= \frac{1}{2} k x^2$$

$$= \frac{1}{2} k (\Delta x)^2$$

Second Newton Law

$$F = m a$$

$$F - F_g = m a$$

Energy, power, work

$$E = m g h$$

$$E = \frac{1}{2} m v^2$$

$$P = \frac{\text{Work}}{\text{time}} = \frac{W(J)}{T(s)} = F v$$

$$\text{Work} = \frac{1}{2} F \cdot (\Delta x)^2$$

