UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2014/2015

COURSE NAME	:	STATICS AND DYNAMICS
COURSE CODE	:	BFC 10102
PROGRAMME	:	BACHELOR OF CIVIL ENGINEERING WITH HONOURS
EXAMINATION DATE	:	JUNE 2015/JULY 2015
DURATION	:	2 HOURS
INSTRUCTION	:	ANSWER THREE QUESTIONS ONLY

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

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 900Nm 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 12 km/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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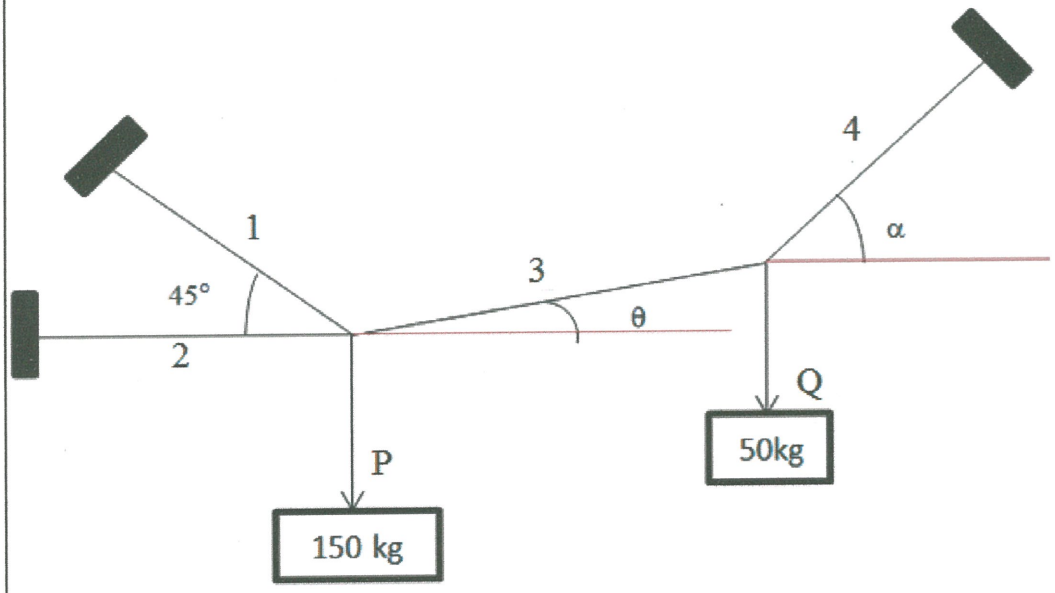

FIGURE Q1(a)

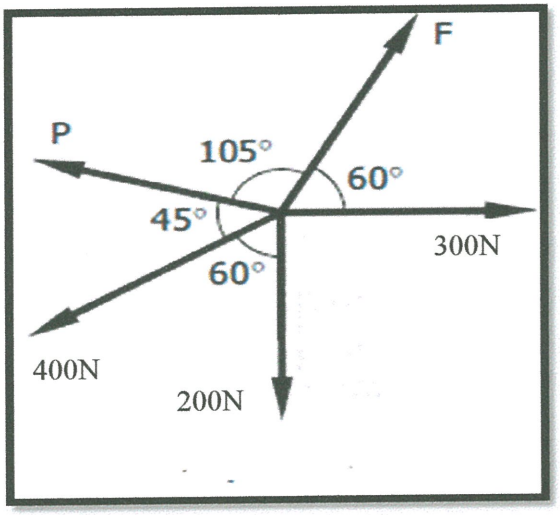

FIGURE Q1(b)

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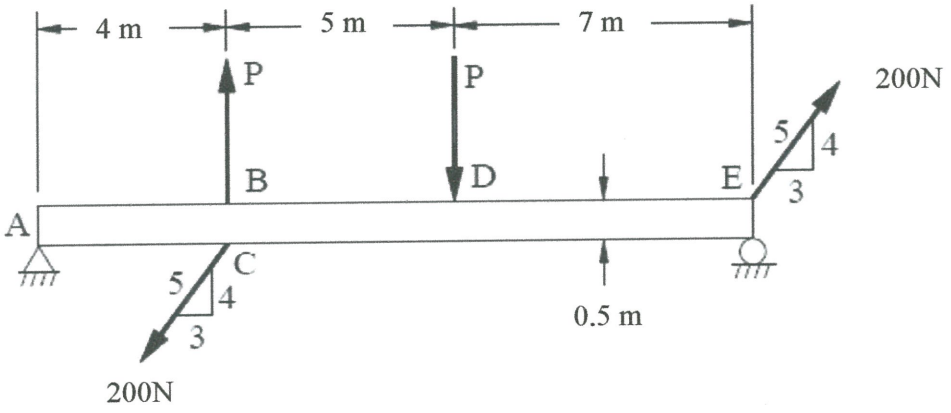
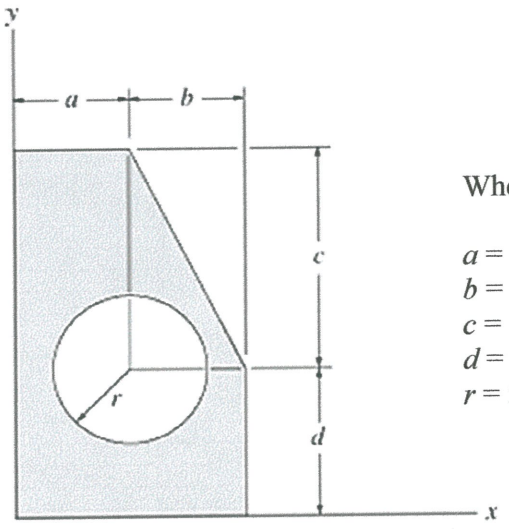


FIGURE Q2



Where;

a = 100mm
b = 100mm
c = 150mm
d = 120mm
r = 50mm

FIGURE Q3

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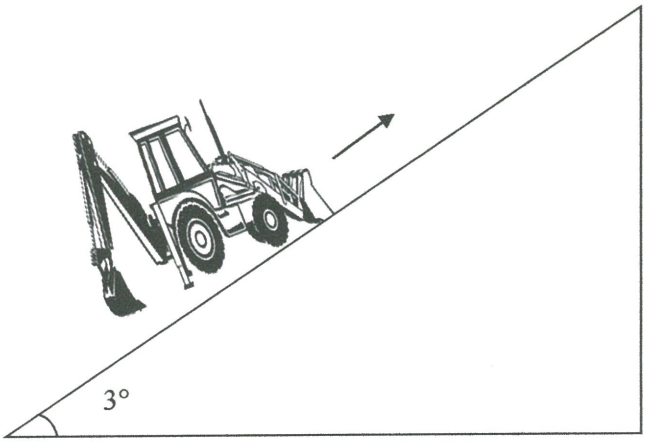

FIGURE Q4

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APPENDIX

TABLE 1 : Centroid

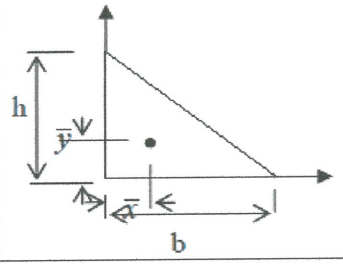
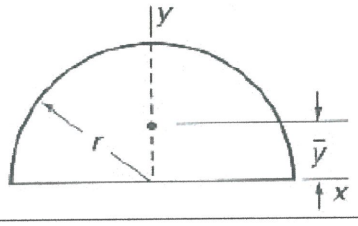
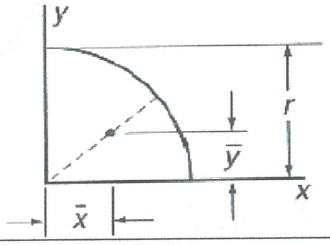
	SHAPE	$\bar{x}$	$\bar{y}$	A
Triangle		$\frac{b}{3}$	$\frac{h}{3}$	$\frac{1}{2}bh$
Semicircle		0	$\frac{4r}{3\pi}$	$\frac{\pi r^2}{2}$
Quarter circle		$\frac{4r}{3\pi}$	$\frac{4r}{3\pi}$	$\frac{\pi r^2}{4}$

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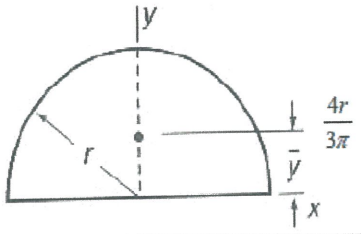
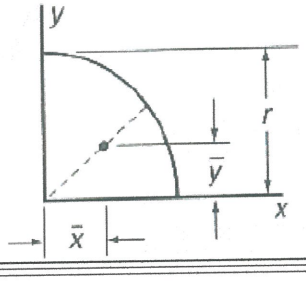
TABLE 2 : Moment of Inertia

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

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LIST OF EQUATION

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

$$v = v_0 + at$$

$$v^2 = v_0{}^2 + 2as$$

Hooke's Law

$$U = \tfrac{1}{2} Fx \quad @ \tfrac{1}{2} Fs$$

$$= \tfrac{1}{2} kx^2$$

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

Second Newton Law

$$F = ma$$

$$F - F_g = ma$$

Energy, power, work

$$E = mgh$$

$$E = \tfrac{1}{2} mv^2$$

$$P = \frac{Work}{time} = \frac{W(J)}{T(s)} = Fv$$

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