Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2018/2019

COURSE NAME	:	STATICS
COURSE CODE	:	BNP 10102
PROGRAMME CODE	:	BNA/BNB/BNC
EXAMINATION DATE	:	JUNE/JULY 2019
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **ELEVENTH (11)** PAGES

Q1 (a) Define the meaning of vector and scalar.

(3 marks)

(b) Briefly explains the different between point load and distributed load.

(3 marks)

(c) Solve the rersultant moments of the three forces in **Figure Q1(c)** at x-axis, y-axis and z-axis.

(9 marks)

(d) Two children are swinging from 12 ft long jungle gym that weights 50 lbs as shown in **Figure Q1(d).** Given child C weights 80 lbs and child D weights 70 lbs.

(i) Draw free body diagram

(4 marks)

(ii) Calculate the reaction for the pin at A and roller at B.

(6 marks)

Q2 (a) State the friction laws for dry surfaces on horizontal surface.

(5 marks)

(b) A man pushes a 100 kg box up an incline horizontally with a force P of 700N as shown in **Figure Q2(b).** Given the coefficient of friction between the box and plane are μ_s = 0.3 and μ_k = 0.2.

(i) Draw the free body diagram (FBD) of the block.

(3 marks)

(ii) Determine whether the block is in equilibrium and find the value of the friction force

(7 marks)

(c) A dockworker adjust a rope which keeps a ship from drifting alongside a wharf. If he exerts a pull of 150 N on the rope, which has 3 full turns around the mooring bit and creating the tension in the rope is 7500 N as shown in **Figure Q2(c).**

(i) Calculate the coefficient of friction between ropes.

(4 marks)

(ii) Analyze the tension in the rope that could be resisted by 200 N force and that the rope has 4 full turns around the mooring bit.

(6 marks)

Q3 (a) List **THREE (3)** main types of centroid.

(6 marks)

(b) Using the method of composite curves, determine the centroidal coordinates of the line in **Figure Q3(b)** that consists of the circular arc 1, and the straight lines 2 and 3.

(8 marks)

(c) Calculate the location of the centroid of the shaded area shown in **Figure Q3(c)**.

(11 marks)

Q4 (a) Briefly explain the moment of inertia for a simple area.

(3 marks)

(b) Determine the moment of inertia at x-axis and y-axis, and analyze the radius of gyration of the composite areas as shown in **Figure Q4(b).**

(10 marks)

(c) Calculate the moment of inertia of the composite area about the x-axis and y-axis as shown in **Figure Q4(c).**

(12 marks)

– END OF QUESTIONS –

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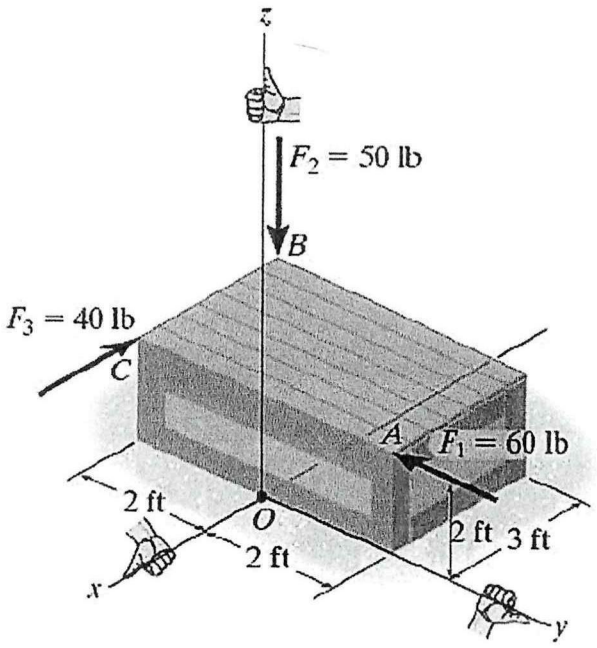

Figure Q1(c) Three forces acting on the box

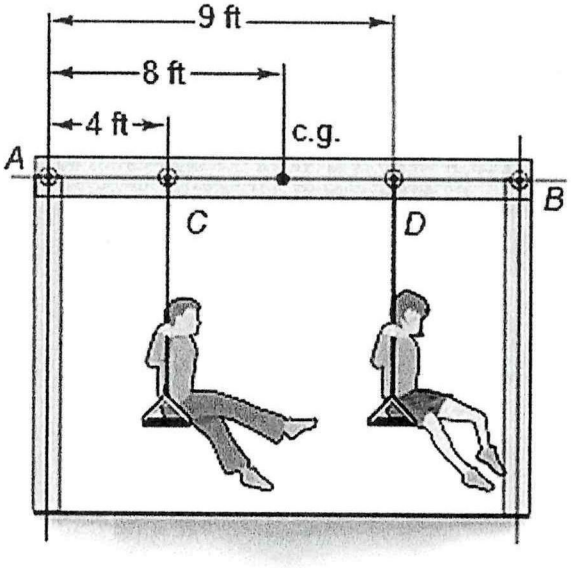

Figure Q1(d) Two children swinging from long jungle gym

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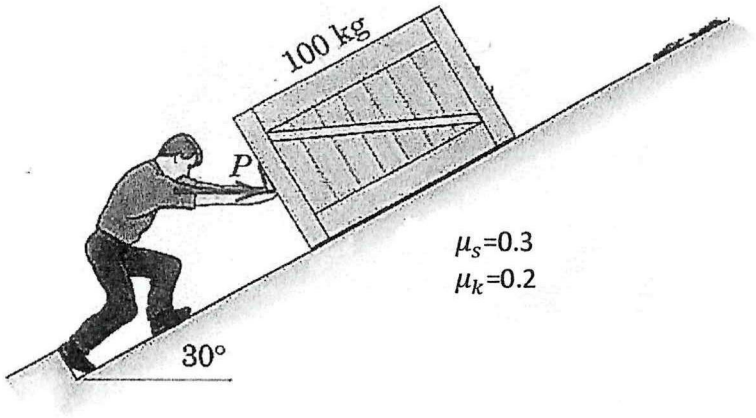

Figure Q2(b) Man pushes a 100kg box

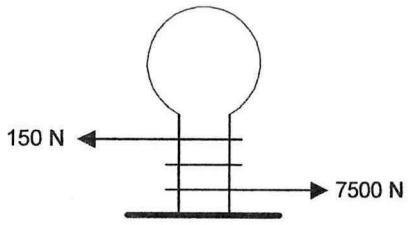

Figure Q2(c) A rope which keeps a ship from drifting alongside a wharf

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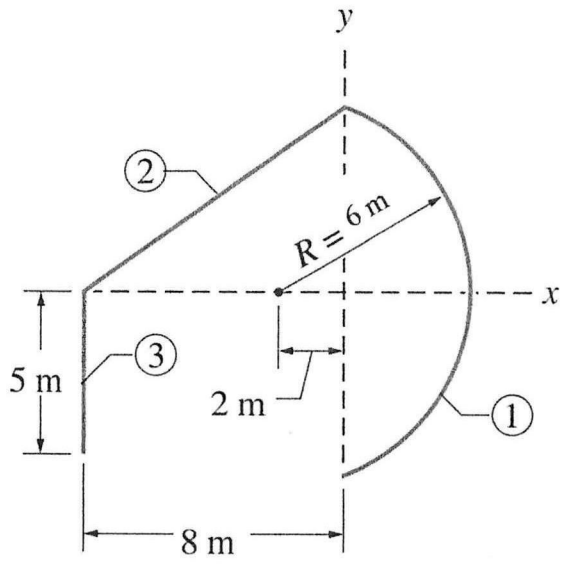

Figure Q3(b)

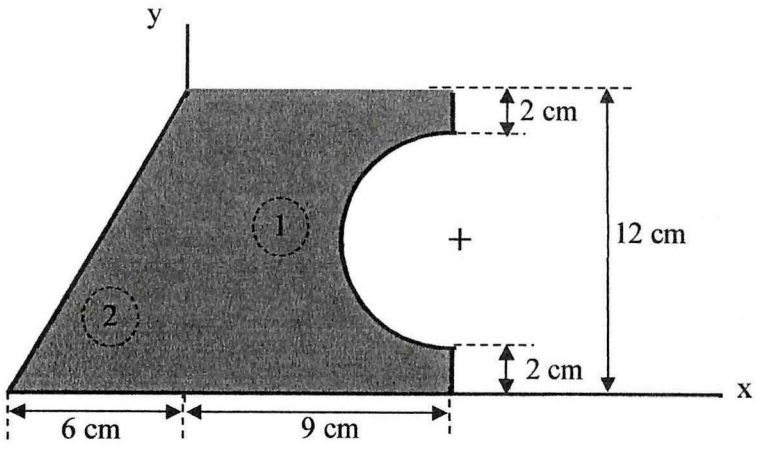

Figure Q3(c)

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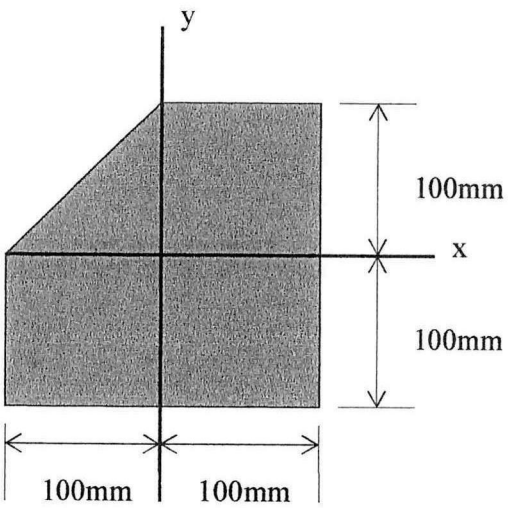

Figure Q4(b)

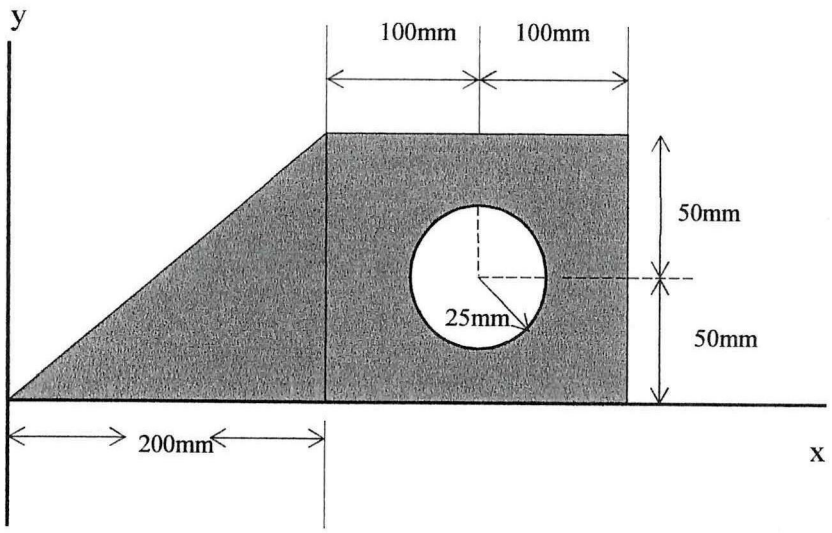

Figure Q4(c)

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Table 1: Centroid of Line

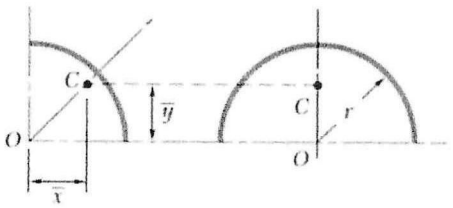
Shape		$\bar{x}$	$\bar{y}$	$\bar{z}$
Quarter-circular arc		$\frac{2r}{\pi}$	$\frac{2r}{\pi}$	$\frac{\pi r}{2}$
Semicircular arc		0	$\frac{2r}{\pi}$	πr

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Table 2: Centroid of Areas

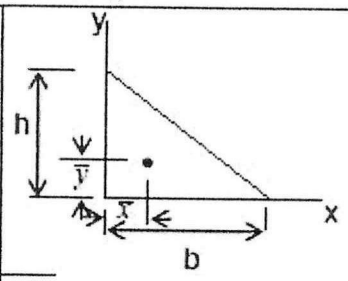
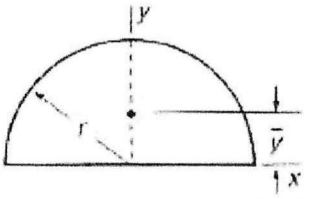
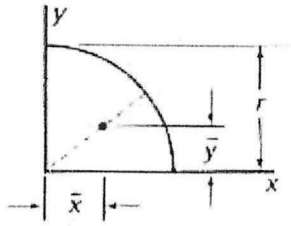
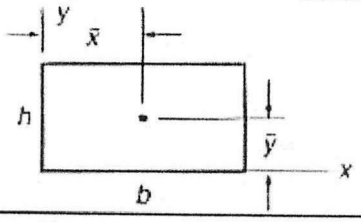
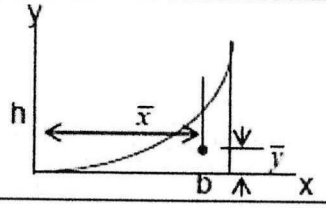
Shape		$\bar{x}$	$\bar{y}$	A
Triangle		$\frac{b}{3}$	$\frac{h}{3}$	$\frac{1}{2}bh$
Semicircle		0	$\frac{4r}{3\pi}$	$\frac{\pi r^2}{2}$
Quarter circle		$\frac{4r}{3\pi}$	$\frac{4r}{3\pi}$	$\frac{\pi r^2}{4}$
Rectangle		$\frac{b}{2}$	$\frac{h}{2}$	bh
Parabolic spanderl		$\frac{3b}{4}$	$\frac{3h}{10}$	$\frac{bh}{3}$

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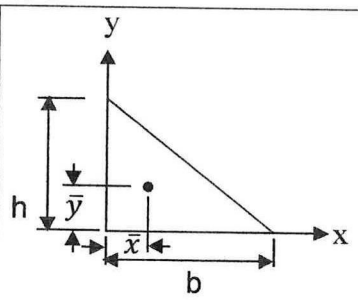
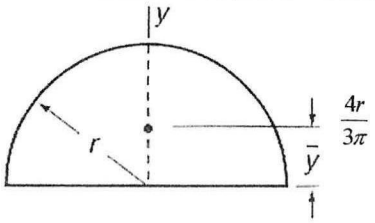
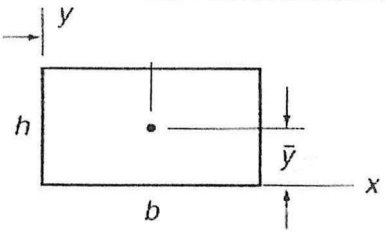
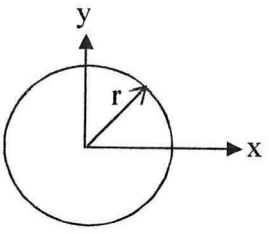
Table 3: Moment of Inertia

Shape		Equation
Triangle		$I_x = \frac{bh^3}{36}, I_y = \frac{b^3h}{36}$
Semicircle		$I_x = 0.1098R^4, I_y = \frac{1}{8}\pi R^4$ $J = \frac{1}{4}\pi r^4$
Rectangle		$I_x = \frac{bh^3}{12}, I_y = \frac{b^3h}{12}$ $J = \frac{1}{12}bh(b^2 + h^2)$
Circle		$I_x = I_y = \frac{1}{4}\pi r^4$ $J = \frac{1}{2}\pi r^4$

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Equations:

$\sum F_x = 0$

$\sum F_y = 0$

$\sum M = 0$

$F_s = F_{max} = \mu_s N = \mu_s (W)$

$F = \mu_k N = \mu_k (W)$

$W = mg$

$T_2 = T_1 e^{\mu\beta}$

$ln\frac{T_2}{T_1} = \mu\beta$

$\bar{x} = \frac{\sum xL}{\sum L}, \quad \bar{y} = \frac{\sum yL}{\sum L}$

$\bar{x} = \frac{\sum xA}{\sum A}, \quad \bar{y} = \frac{\sum yA}{\sum A}$

$I_{xx} = I_x + Ad^2$

$I_{yy} = I_y + As^2$

$k_x = \sqrt{\frac{I_{xx}}{A}}, \quad k_y = \sqrt{\frac{I_{yy}}{A}}$