UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2015/2016

COURSE NAME	:	STATICS
COURSE CODE	:	BDA 10203
PROGRAMME	:	1 BDD
EXAMINATION DATE	:	JUNE 2016 / JULY 2016
DURATION	:	3 HOURS
INSTRUCTION	:	PLEASE ANSWER **FIVE (5)** FROM **SIX (6)** QUESTIONS.

THIS QUESTION PAPER CONSISTS OF **EIGHT(8)** PAGES

Q1   (a)   Free body diagram is an essential tool in static problem evaluation. Discuss the step required in order to sketch an appropriate free body diagram.

(5 marks)

        (b)   Figure **Q1 (a)** shows that Mr. Mohd Nasrull trying to open a nut using a wrench. He applied a 400 N force in the y-direction. Sketch the appropriate free body diagram and solve the forces in x-direction and the magnitude of F.

(5 marks)

        (c)   Figure **Q1 (b)** shows a static condition of a structure. The cable AB is equipped with a turnbuckle that tightened the cable till it has a tension of 1.2kN.

            (i)   Analyze the vector expression for the tension T as force acting along line AB.

(5 marks)

            (ii)   Solve the magnitude of the projection of force along line AC.

(5 marks)

Q2   (a)   The wing of the jet aircraft is subjected to thrust T from its engine and the resultant lift force L. If the mass of the wing is M and the mass center is at G, try to solve the x, y, z components of reaction where the wing is fixed to the fuselage at A.

(9 marks)

        (b)   Derive the equilibrium equations that consists of R, L and Θ for both x-axis and y-axis for the mechanism as shown in Figure **Q2(b)**. The weight of the lever could be considered as W; and OCD forms a quarter circle where R is the radius of the circle and C is the centre of the circle.

(8 marks)

        (c)   Define $a1/b1^2$ to three significant figures and express each answer in SI units using an appropriate prefix.
Given: $a1 := 0.631$Mm and $b1 := 8.60$kg

(3 marks)

Q3 (a) Figure **Q3 (a)** shows the roof truss supports the vertical loading. Determine the force in members BC, CK, and KJ and state if these members are in tension or compression.

(10 marks)

(b) Figure **Q3 (b)** shows a nail cutter consists of the handle and the two cutting blades. Assuming the blades are pin connected at B and the surface at D is smooth, solve the normal force on the fingernail when a force of 5 N is applied to the handles as shown. The pin AC slides through a smooth hole at A and is attached to the bottom member at C.

(6 marks)

(c) List 4 prefixes used in SI units

(4 marks)

Q4 (a) Figure **Q4 (a)** shows a homogeneous thin plate. By using the Method of Composites and the Theorem of Pappus Guldinus,

(i) Sketch the plate position if it's rotate at 45° clockwise from x axis at line x = 400 mm.

(4 marks)

(ii) Calculate the net volume if the plate is fully rotating the area at the line x = 400 mm.

(6 marks)

(b) Figure **Q4(b)** shows the anatomical centre of gravity, G of a person can be determined by using a scale and a rigid board having a uniform weight W_1 and length l. With the person's weight W was given, the person lies down on the board and the scale reading P is recorded as follows:

Given: W= 1000N, W_1 =200N, P=500N, l= 2 m, l_1= 1.3 m

(i) Solve the length x' of the centre of mass.

(6 marks)

(iii) Propose the best place l_1 for the smooth support at B in order to improve the accuracy of this experiment.

(4 marks)

Q5 (a) Figure **Q5 (a)** shows a crate has a mass of 350kg and is subjected to a towing force P acting at a 20° angle with the horizontal. If the coefficient of static friction is μs = 0.5, determine the magnitude of P to just start the crate moving down the plane.

(10 marks)

(b) Figure **Q5 (b)** show block A and block B with the weight of 50 N and 30 N, respectively. Determine the smallest weight of cylinder D which will cause the loss of static equilibrium.

(10 marks)

Q6 (a) Figure **Q6 (a)** shows the S-section about the y axis. Determine the moment of inertia of the S-section.

(6 marks)

(b) Propose a design of billboard in an actual size. The design should include analysis of maximum impact of acting / reaction forces on every elements of the billboard that could make it collapse.

(12 marks)

(c) State two typical units of force.

(2 marks)

–END OF QUESTION –

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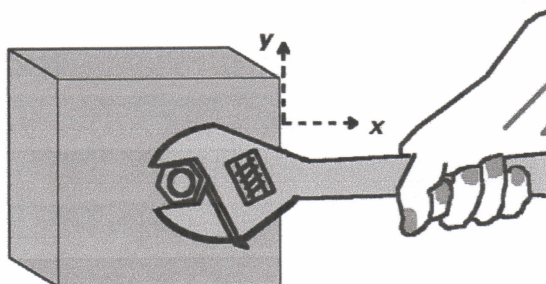
FIGURE Q1 (a)

FIGURE Q1 (b)

Turnbuckel

5m

1m

3m

2m
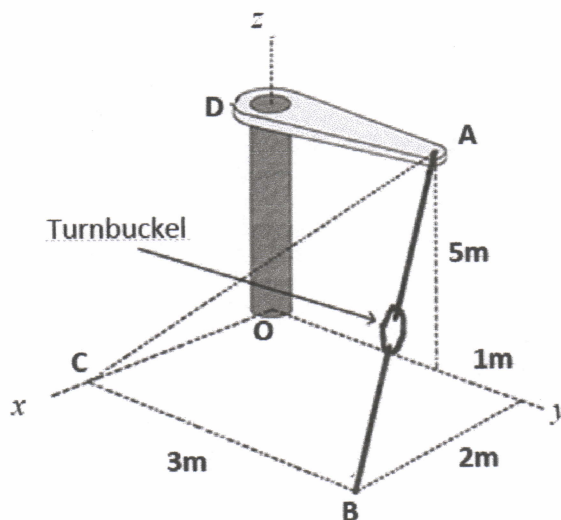
Given:

$T := 8kN$

$L := 45kN$

$M := 2.1Mg$

$a := 2.5m$

$b := 5m$

$c := 3m$

$d := 7m$
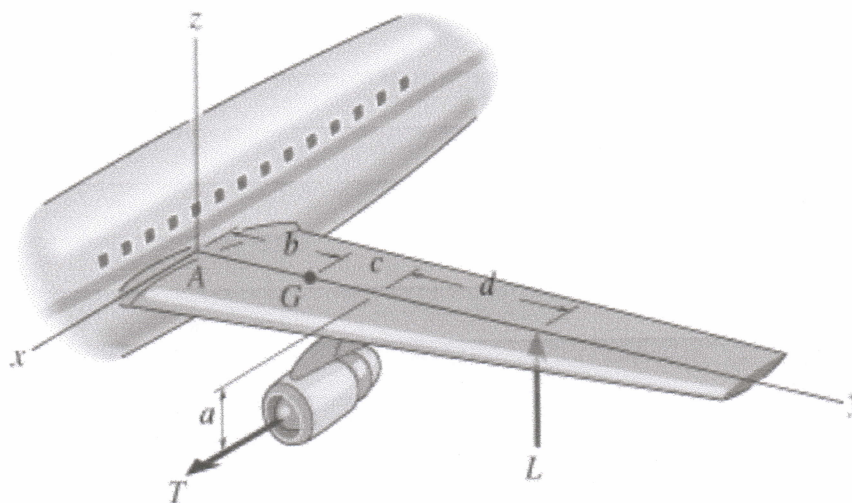
FIGURE Q2 (a)

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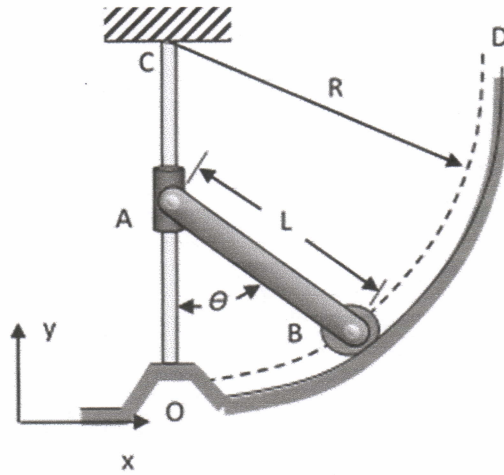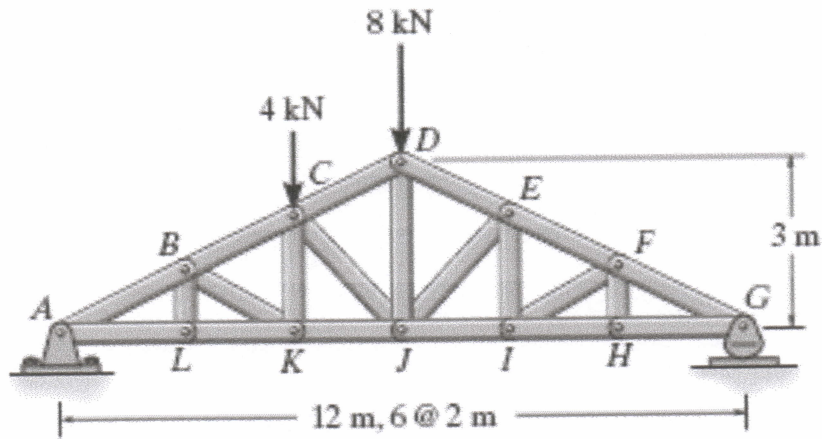
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FIGURE Q2 (b)
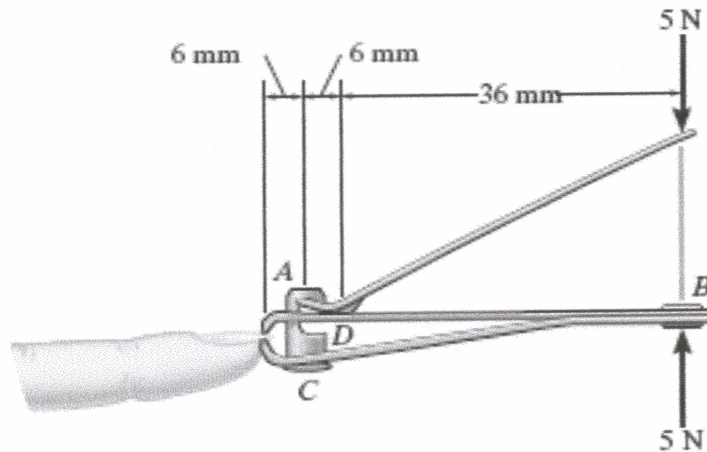
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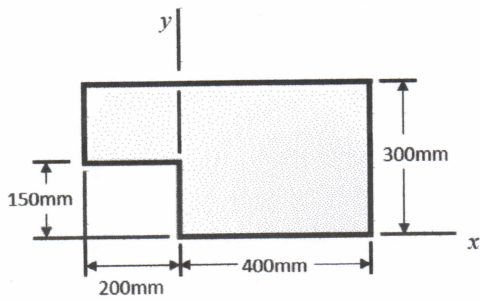
FIGURE Q3 (b)

FIGURE Q4(a)

FIGURE Q4(b)

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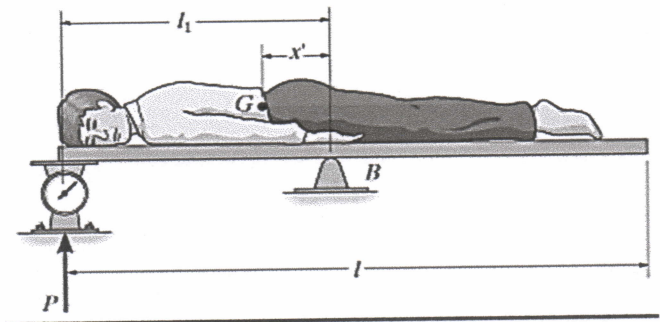
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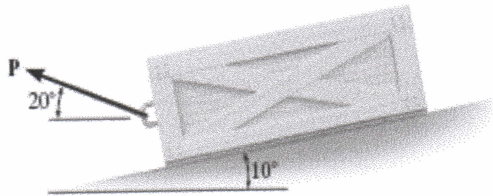
FIGURE Q5(a)

FIGURE Q5(b)

FIGURE Q6 (a)