Document No : UniKL MFI_SD_AC41
Revision No: 02
Effective Date: 01 December 2008

CONFIDENTIAL

SET B

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
JANUARY 2010 SESSION

SUBJECT CODE	:	FMB 15203
SUBJECT TITLE	:	STATICS
LEVEL	:	BACHELOR
TIME / DURATION	:	3.00pm – 5.30pm (2.5 HOURS)
DATE	:	30 APRIL 2010

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. Please write your answers on the answer booklet provided.
4. Answer should be written in blue or black ink except for sketching, graphic and illustration.
5. This question paper consists of TWO (2) sections. Section A and B. Answer TWO (2) questions in section A. For section B, answer THREE (3) questions only.
6. Answer ALL questions in English.

THERE ARE 5 PAGES OF QUESTIONS AND 2 PAGES OF APPENDICES, EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

INSTRUCTION: Answer Two (2) questions only.

Question 1

(a) State the First Law of Newton's Laws of Motion.

(2 marks)

(b) Differentiate between mass, m, and weight, W, and state the SI units of measure for each of these quantities.

(3 marks)

(c) The cables each exert a force of 400 N on the post in Figure 1 below. Determine the magnitude of the projected component of F_1 long the line of action of F_2.

(15 marks)

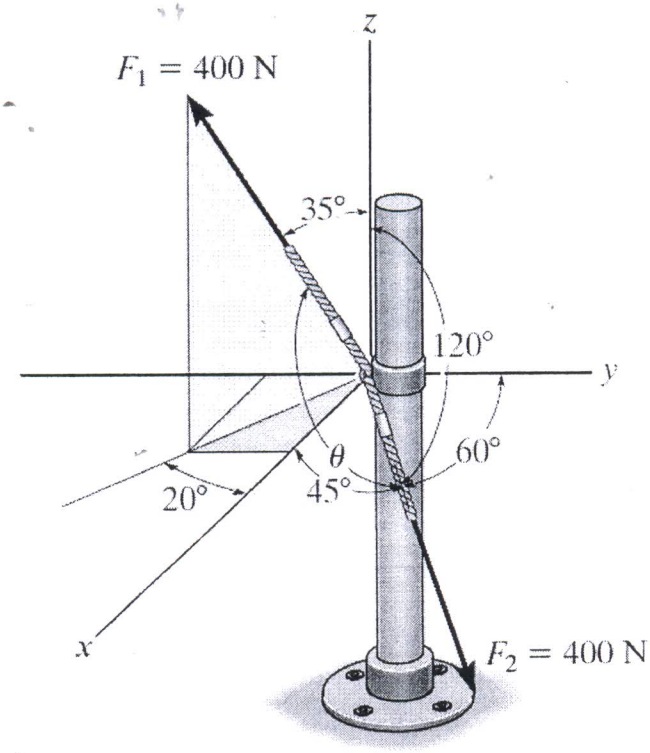


Figure 1

Question 2

Three cables are used to suspend a crate as shown in Figure 2 below. Determine the maximum weight of the crate so that the tension developed in any cable does not exceed 2250 N.

(20 marks)

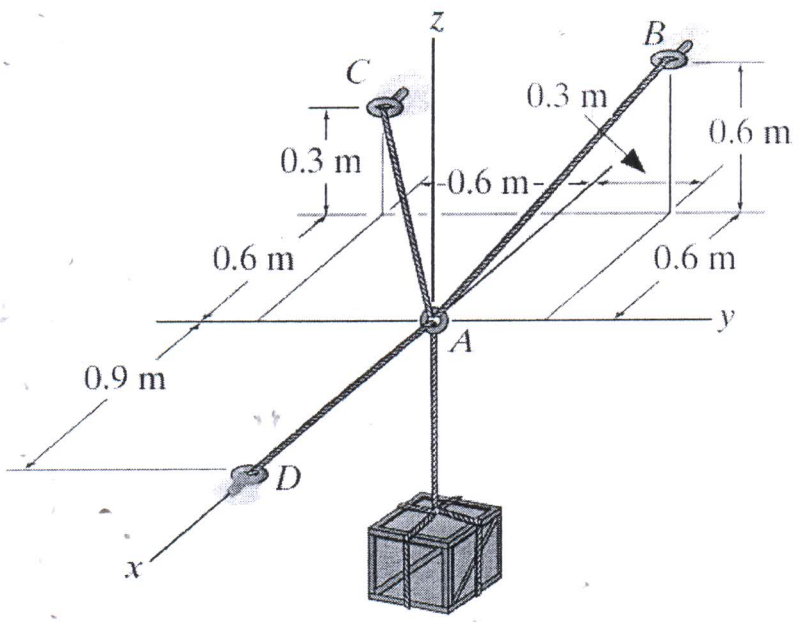


Figure 2

Question 3

(a) The gravity wall is made of concrete. Determine the location (x, y) of the center of mass *G* for the wall shown in Figure 3 below.

(10 marks)

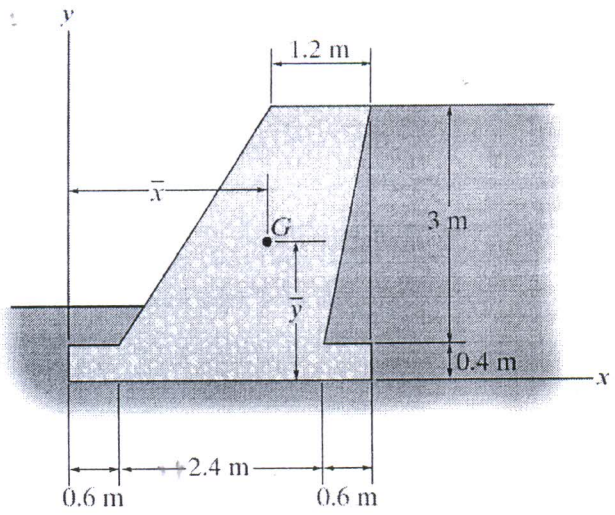


Figure 3

(b) Locate the center of mass of the assembly. The hemisphere and the cone are made from materials having densities of 8 Mg/m^3 and 4 Mg/m^3, respectively.

(10 marks)

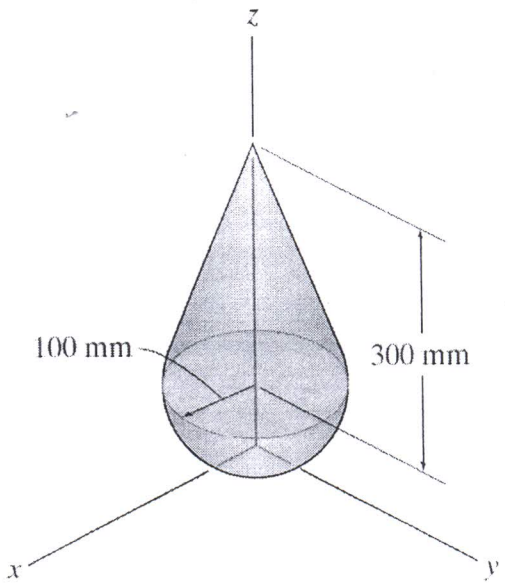


Figure 4

SECTION B (Total: 60 marks)

INSTRUCTION: Choose and Answer Three (3) questions only.

Question 4

Two boxes are stacked together with each box weighs 75kg as shown in Figure 5 below. A man applies a horizontal force on the top box in order to cause motion. The coefficient of static friction between the boxes is $\mu_s = 0.5$, and the coefficient of static friction between the box and the floor is $\mu'_s = 0.2$.

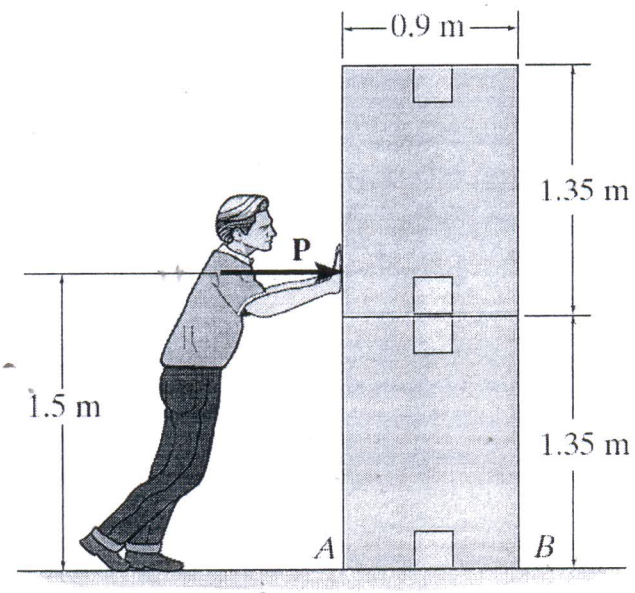


Figure 5

(a) Draw the Free Body Diagrams for the boxes.

(5 marks)

(b) Determine the least horizontal force *P* that the man must exert on the top box in order to cause motion.

(15 marks)

Question 5

Determine the force in members *IJ*, *EJ*, and *CD* of the *Howe* truss shown in Figure 7 below, and state if the members are in tension or compression.

(20 marks)

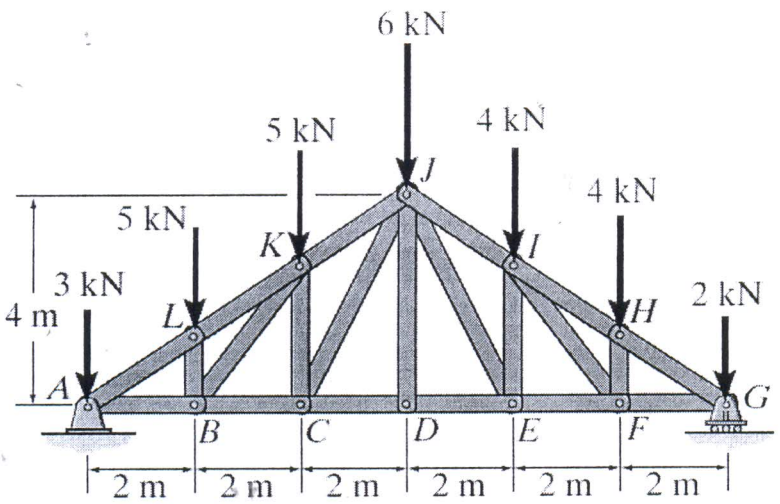


Figure 6

Question 6

A beam is supported at both ends A and B as shown in Figure 7 below. If L = 9m, the beam will fail when the maximum shear force is V_{max} = 5 kN or the maximum bending moment is M_{max} = 22 kN.m. Determine the largest couple moment M_0 the beam will support, draw the shear and moment diagrams for the beam.

(20 marks)

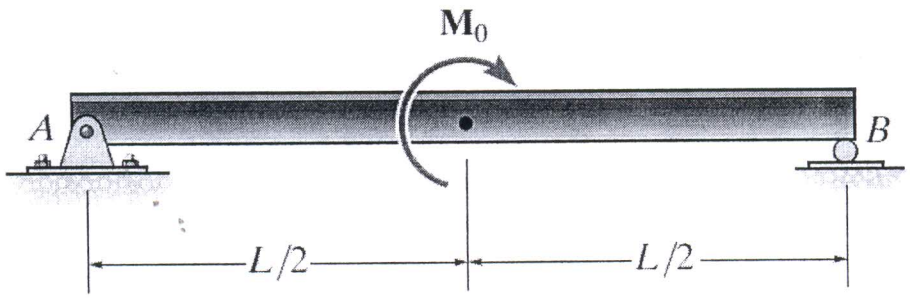
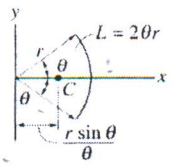
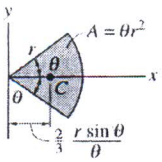
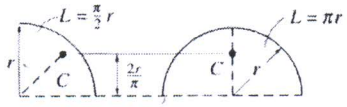
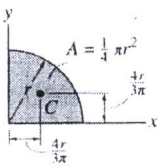
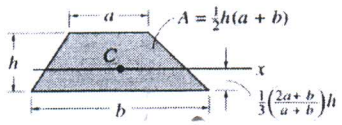
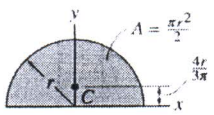
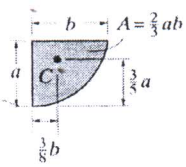
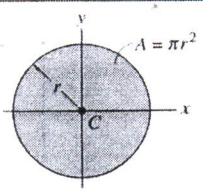
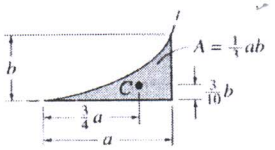
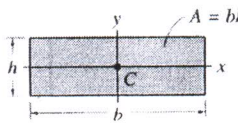
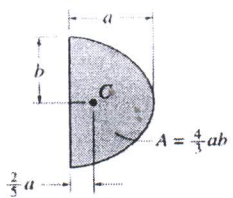
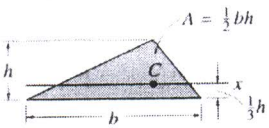


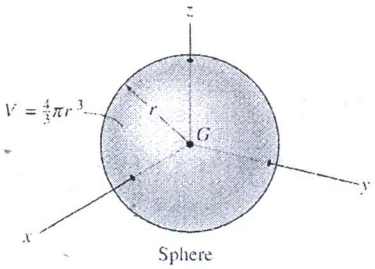
Figure 7

Appendix :

Geometric Properties of Line and Area Elements

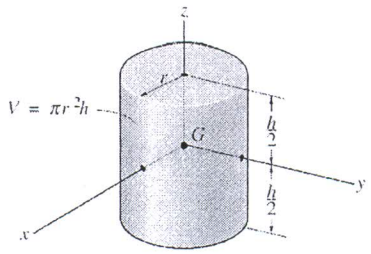
Centroid Location	Centroid Location	Area Moment of Inertia
 Circular arc segment	 Circular sector area	$I_x = \frac{1}{4}r^4(\theta - \frac{1}{2}\sin 2\theta)$ $I_x = \frac{1}{4}r^4(\theta + \frac{1}{2}\sin 2\theta)$
 Quarter and semicircle arcs	 Quarter circle area	$I_x = \frac{1}{16}\pi r^4$ $I_y = \frac{1}{16}\pi r^4$
 Trapezoidal area	 Semicircular area	$I_x = \frac{1}{8}\pi r^4$ $I_y = \frac{1}{8}\pi r^4$
 Semiparabolic area	 Circular area	$I_x = \frac{1}{4}\pi r^4$ $I_y = \frac{1}{4}\pi r^4$
 Exparabolic area	 Rectangular area	$I_x = \frac{1}{12}bh^3$ $I_y = \frac{1}{3}hb^3$
 Parabolic area	 Triangular area	$I_x = \frac{1}{36}bh^3$

Center of Gravity and Mass Moment of Inertia of Homogeneous Solids



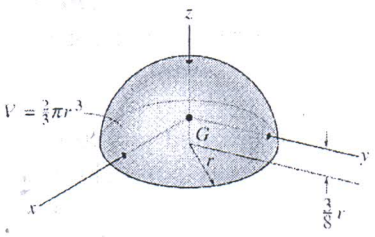
Sphere

$I_{xx} = I_{yy} = I_{zz} = \frac{2}{5}mr^2$



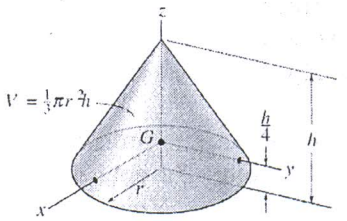
Cylinder

$I_{xx} = I_{yy} = \frac{1}{12}m(3r^2 + h^2)$ $I_{zz} = \frac{1}{2}mr^2$



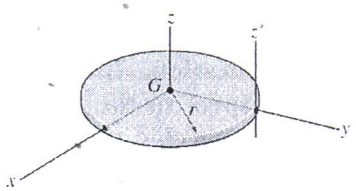
Hemisphere

$I_{xx} = I_{yy} = 0.259mr^2$ $I_{zz} = \frac{2}{5}mr^2$



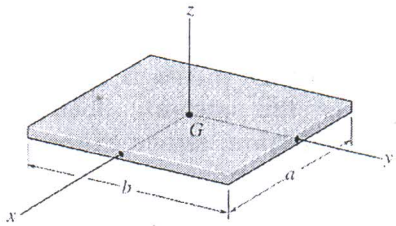
Cone

$I_{xx} = I_{yy} = \frac{3}{80}m(4r^2 + h^2)$ $I_{zz} = \frac{3}{10}mr^2$



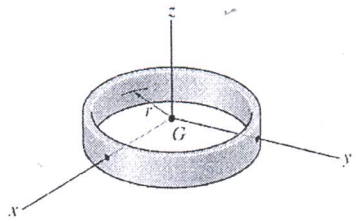
Thin Circular disk

$I_{xx} = I_{yy} = \frac{1}{4}mr^2$ $I_{zz} = \frac{1}{2}mr^2$ $I_{z'z'} = \frac{3}{2}mr^2$



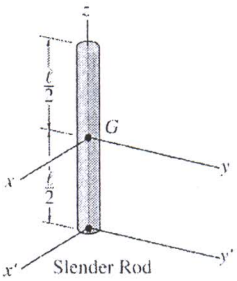
Thin plate

$I_{xx} = \frac{1}{12}mb^2$ $I_{yy} = \frac{1}{12}ma^2$ $I_{zz} = \frac{1}{12}m(a^2 + b^2)$



Thin ring

$I_{xx} = I_{yy} = \frac{1}{2}mr^2$ $I_{zz} = mr^2$



Slender Rod

$I_{xx} = I_{yy} = \frac{1}{12}m\ell^2$ $I_{x'x'} = I_{y'y'} = \frac{1}{3}m\ell^2$ $I_{z'z'} = 0$

END OF QUESTION