INTI International University & Colleges

FINAL
ALTERNATIVE ASSESSMENT

(COVER PAGE)

Session	:	**January 2022**
Programme	:	Diploma in Mechanical Engineering (DMEN)
Course	:	**EGR1174: Engineering Statics**
Date of Examination	:	8th March 2022 (Tuesday)
Time	:	8.00am – 10.30am Reading Time : Nil
Duration	:	2 Hours 30 Minutes

Note: 30 minutes is added into the duration of the examination to factor in any connectivity matters and for you to scan and upload your scripts.

Special Instructions :

This paper consists of **FOUR (4)** questions. Answer all **FOUR (4)** questions. All questions carry equal marks.

Material permitted :

Non-Programmable Scientific Calculator

Materials provided :

Formulae List - Geometric Properties of Line and Area Elements

Examiner(s)	:	**Koh Mui Siang** and Nur Hafizah Habideen
Chief Moderator	:	Ms Iylia Elena Abdul Jamil

This paper consists of 7 printed pages, including the cover page

DIPLOMA IN MECHANICAL ENGINEERING PROGRAMME (DMEN)
EGR1174: ENGINEERING STATICS
FINAL ALTERNATIVE ASSESSMENT: JANUARY 2022 SESSION

Instructions: This paper consists of **FOUR (4)** questions. Answer all **FOUR (4)** questions. All questions carry equal marks.

Question 1

Evaluate the force in members *CD, CM, EF, EP*, and *LK* of the Baltimore bridge truss as shown in Figure Q1. Identify whether the members are in tension or compression. (Given OC is a Zero-Force member).

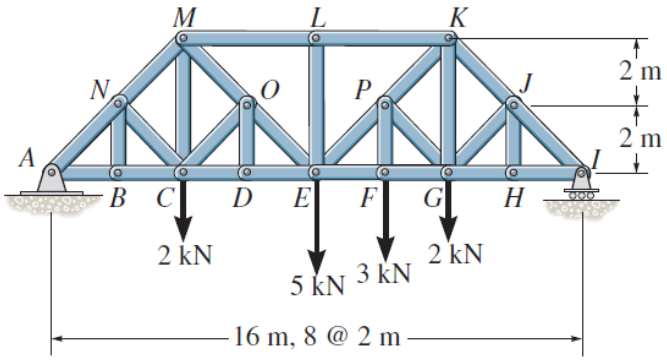


Figure Q1

(25 marks)

Question 2

A man with a weight of 150 N attempts to push the cabinet of 90 N that rests on the floor as shown in Figure Q2. The coefficient of static friction between the floor and bottom of the cabinet is 0.25.

Determine the minimum force **F** needed to move the cabinet and the smallest coefficient of static friction between his shoes and the floor so that he does not slip for the following two conditions.

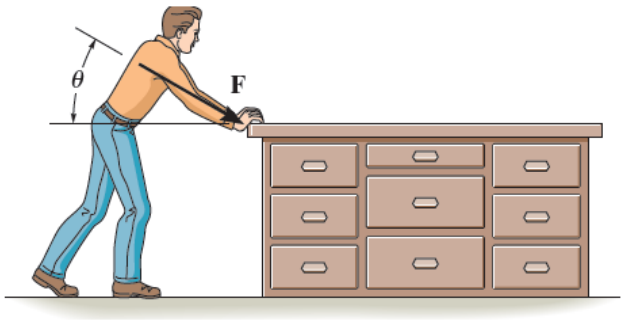


Figure Q2

(a) If the man pushes on the cabinet in the horizontal direction.

(8 marks)

(b) If the man pushes on the cabinet in the direction θ = 30˚.

(17 marks)

Question 3

Figure Q3 shows a supported beam at both point *A* and point *C*. Point *A* is pin-jointed, and point *C* is roller. The length of the beam is 3 m.

(a) Determine the support reaction at *A* and *C*.

(9 marks)

(b) Illustrate the shear and moment diagrams of the beam.

(16 marks)

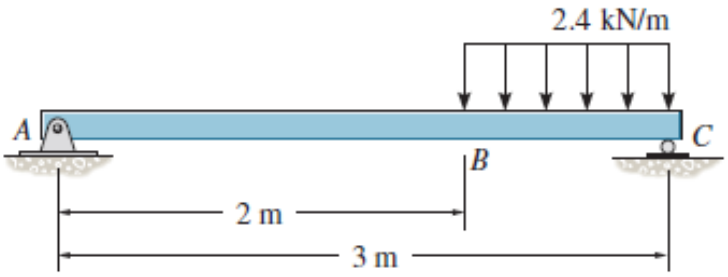


Figure Q3

Question 4

(a) Determine the *x*-coordinate of centroid for length of the sheet steel shown in Figure Q4(a). The dimensions are indicated at the center thickness of each segment.

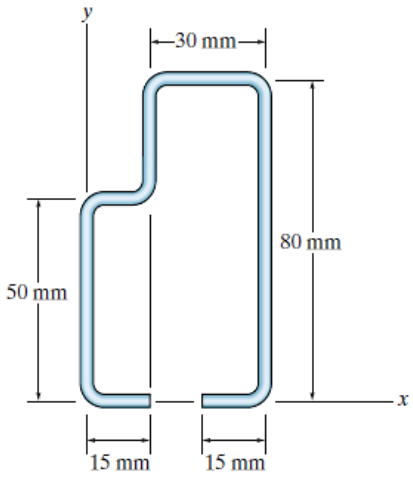


Figure Q4(a)

(9 marks)

(b) Identify the *y*-coordinate of centroid for the cross sectional area shown in Figure Q4(b) and then determine the moment of inertia about the *x'* axis.

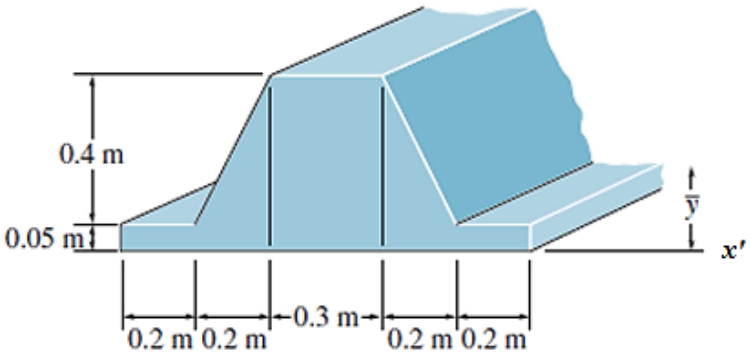
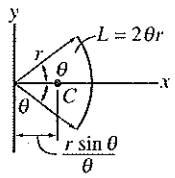
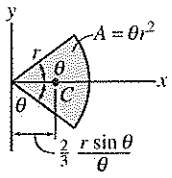
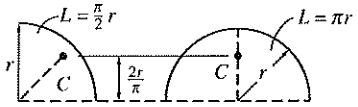
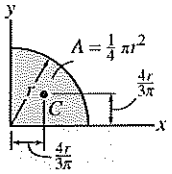
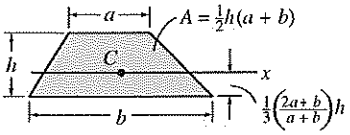
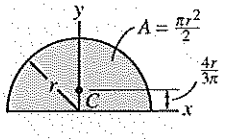
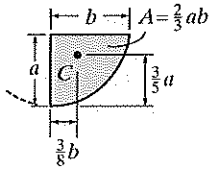
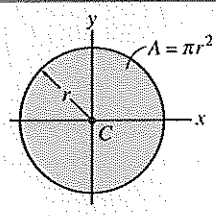
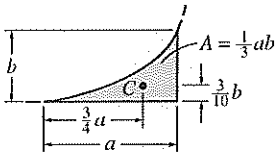
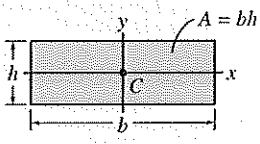
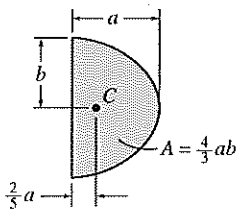
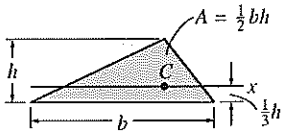


Figure Q4(b)

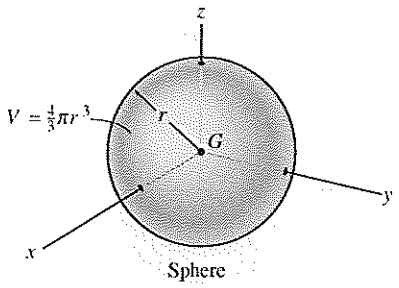
(16 marks)

-THE END-

Geometric Properties of Line and Area Elements

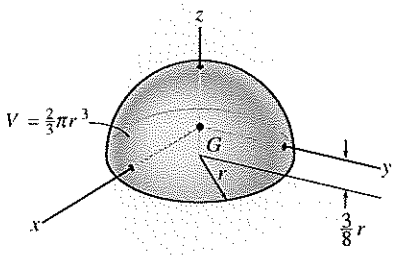
Centroid Location	Centroid Location	Area Moment of Inertia
 Circular arc segment	 Circular sector area	$I_x = \frac{1}{4}r^4(\theta - \frac{1}{2}\sin 2)\theta$ $I_y = \frac{1}{4}r^4(\theta + \frac{1}{2}\sin 2)\theta$
 Quarter and semicircle arcs	 Quarter circle area	$I_x = \frac{1}{16}\pi r^4$ $I_y =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

Center of Gravity and Mass Moment of Inertia of Homogeneous Solids



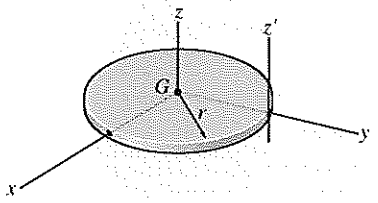
Sphere

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



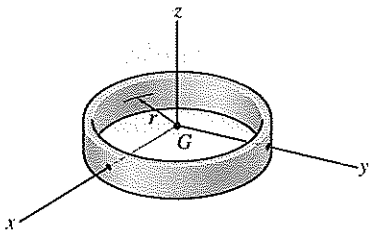
Hemisphere

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



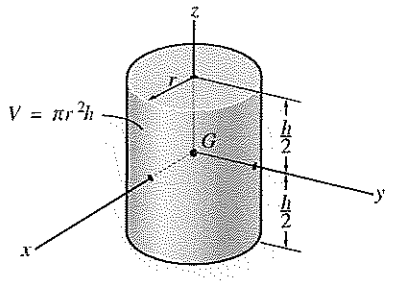
Thin Circular disk

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



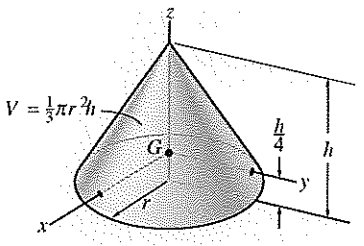
Thin ring

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



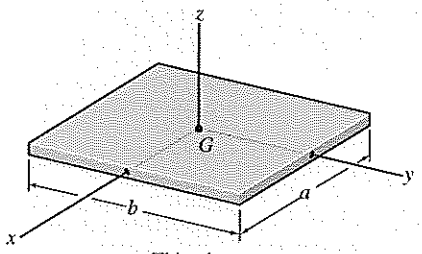
Cylinder

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



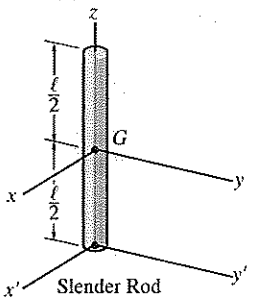
Cone

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



Thin plate

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



Slender Rod

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