INTI International University & Colleges

FINAL
Examination Paper

(COVER PAGE)

Session	:	**April 2019**
Programme	:	Diploma In Mechanical Engineering (DMEN)
Course	:	**EGR1174 : Engineering Statics**
Date of Examination	:	August 3, 2019 (Saturday)
Time	:	8:00 am – 10:00 am Reading Time: Nil
Duration	:	2 Hours
Special Instructions	:	

This paper consists of **SIX (6)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Materials permitted :

Non Programmable Calculator

Materials provided :

Geometric Properties of Line and Area Elements
Center of Gravity and Mass Moment of Inertia of Homogeneous Solids

Examiner (s)	:	**Jaisatia Varthani** & Koh Mui Siang
Moderator	:	Ir Gerald Victor Richard Joseph

*This paper consists of **9** printed pages, including the cover page.*

DIPLOMA IN MECHANICAL ENGINEERING POGRAMME (DMEN)
EGR1174 : ENGINEERING STATICS
FINAL EXAMINATION : APRIL 2019 SESSION

Instructions: This paper consists of **SIX (6)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Question 1

(a) A trolley as shown in Figure Q1(a) moves along a horizontal beam is acted upon by two forces.

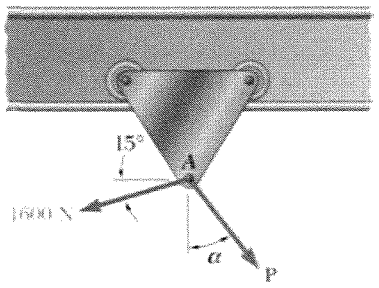


Figure Q1(a)

(i) Knowing that $\alpha = 25°$, determine by trigonometry the magnitude of the force P so that the resultant force exerted on the trolley is vertical.

(6 marks)

(ii) What is they corresponding magnitude of the resultant force?

(4 marks)

(b) The three cables in Figure Q1(b) are used to support the 40-kg flowerpot. Determine the force developed in each cable for equilibrium

(15 marks)

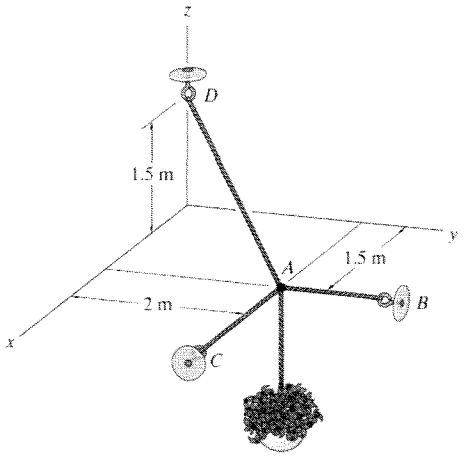


Figure Q1(b)

Question 2

(a) Determine the moment of each of the three forces about point A in Figure Q2(a).
(9 marks)

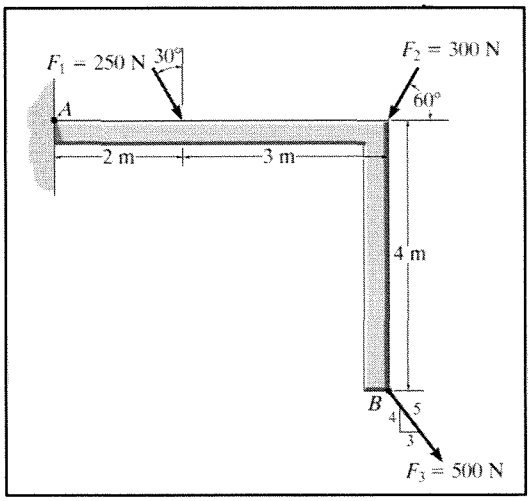


Figure Q2(a)

(b) Determine the horizontal and vertical components of reaction for the beam in FigureQ2(b).
(16 marks)

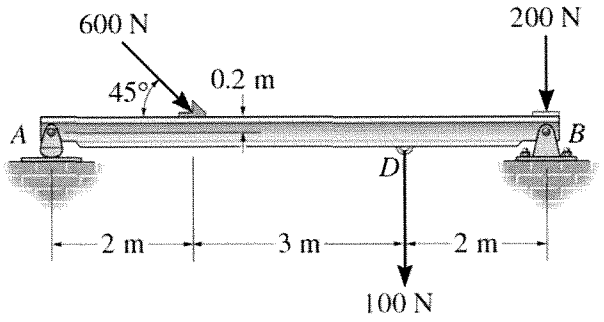


Figure Q2(b)

Question 3

(a) Determine the force in each member of the truss in Figure Q3(a) in terms of the external loading and state if the members are in tension or compression. Take P = 2 kN.

(12 marks)

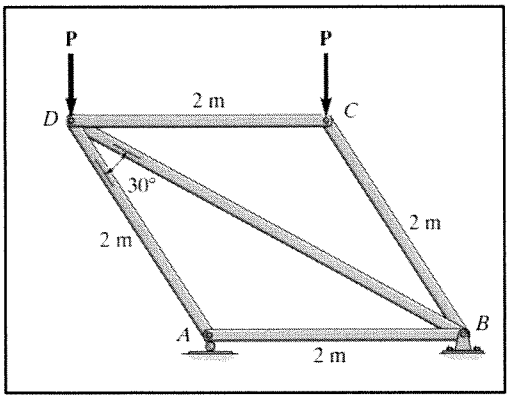


Figure Q3 (a)

(b) Determine the force in members JK, CJ, and CD of the truss, and state if the members are in tension or compression in Figure Q3(b) .

(13 marks)

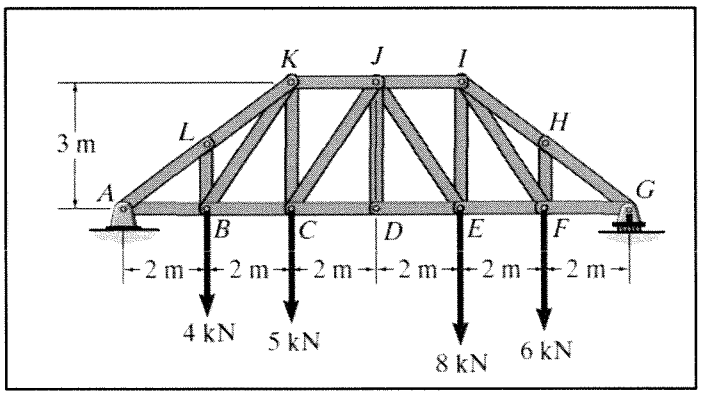


Figure Q3 (b)

Question 4

(a) The 100-kg disk in Figure Q4(a) rests on a surface for which $\mu_s = 0.2$. Determine the smallest vertical force P that can be applied tangentially to the disk which will cause motion to happen.

(10 marks)

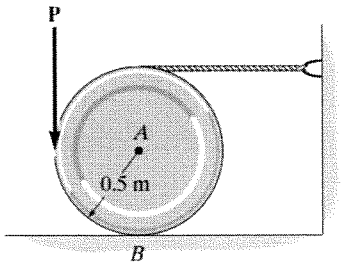


Figure Q4 (a)

(b) The automobile has a mass of 2 Mg and center of mass at G. Determine the towing force F required to move the car if the back brakes are locked, and the front wheels are free to roll. Take $\mu s = 0.3$.

(15 marks)

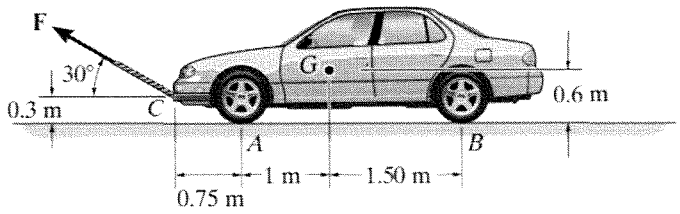
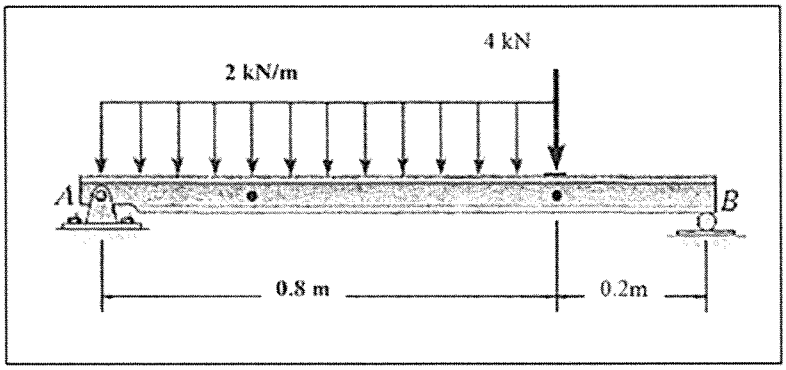


Figure Q4 (b)

Question 5

For the distributed loading system in Figure Q5, where A is pin-connected and B is roller-supported. Please take point A as the origin.



(a) Determine the support reaction at A and B

(4 marks)

(b) Determine the shear and moment as a function of x and

(15 marks)

(c) Draw the shear and moment diagrams for the shaft.

(6 marks)

Question 6

(a) Locate the centroid of the plate area shown in Figure Q6(a) below

(10 marks)

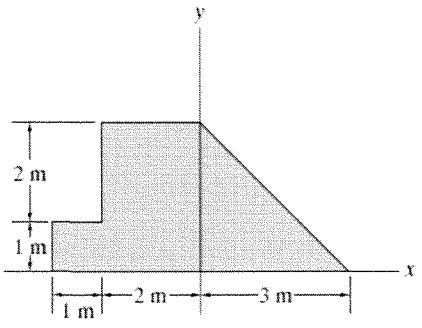


Figure Q6 (a)

(b) In Figure 6(b), determine $\bar{y}$, which locates the centroidal axis x' for the cross-sectional area of the T-beam, and then find the moments of inertia $I_{x'}$ and $I_{y'}$.

(15 marks)

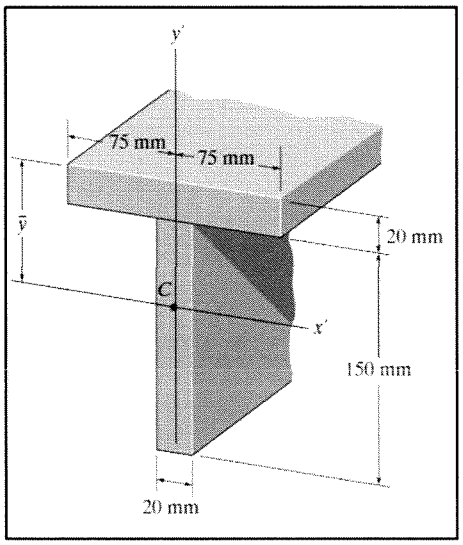


Figure Q6 (b)

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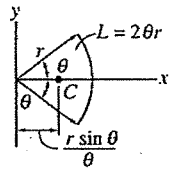
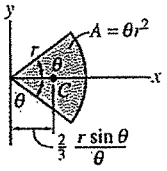
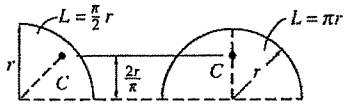
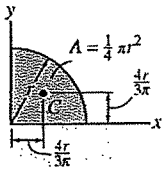
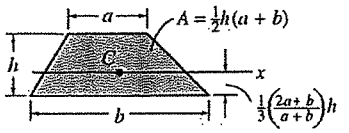
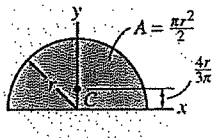
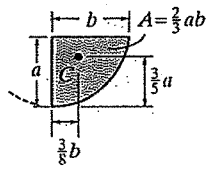
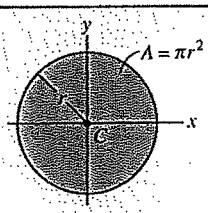
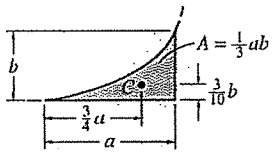
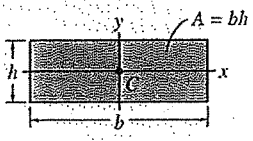
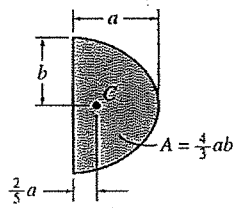
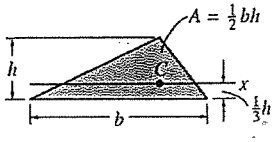
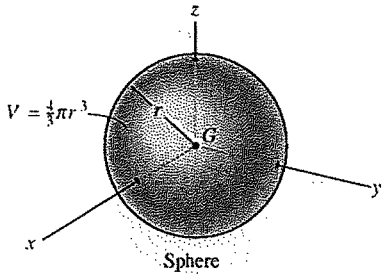
Geometric Properties of Line and Area Elements

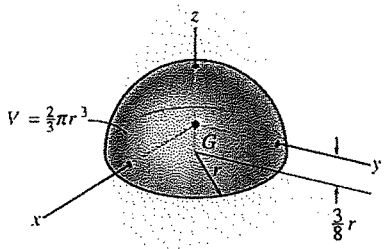
Centroid Location	Centroid Location	Area Moment of Inertia
 Circular arc segment	 Circular sector area	$I_x = \frac{1}{4}r^4(\theta - \frac{1}{2}\sin 2)\theta$ $I_y = \frac{1}{4}r^4(\theta + \frac{1}{2}\sin 2)\theta$
 Quarter and semicircle arcs	 Quarter circle area	$I_x = \frac{1}{16}\pi r^4$ $I_y =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



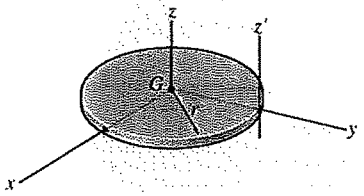
Sphere

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



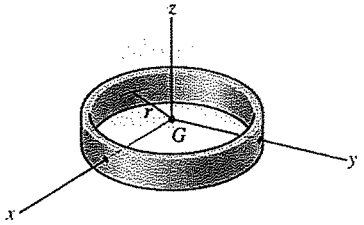
Hemisphere

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



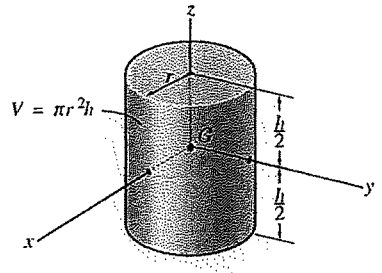
Thin Circular disk

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



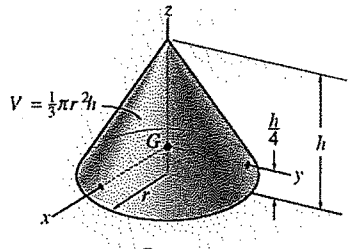
Thin ring

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



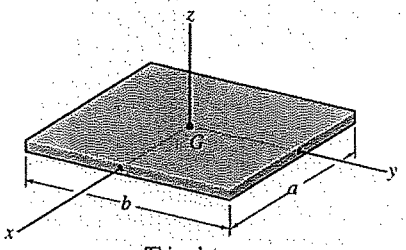
Cylinder

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



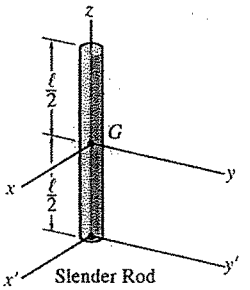
Cone

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



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

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