King Fahd University of Petroleum & Minerals

Department of Civil and Environmental Engineering

CE 201 – Statics

Semester: 121
Examination: Final
Date (Day): January 8, 2013 (Tuesday)
Time: 07:00 – 10:00 p.m.

Section	1	2	3	4	5	6	7	8	10	9	11
Instructor	Malack	Malack	Schowdhury	Amoudi	Hussein	Gadhib	Vohra	Senan	Senan	Sharif	Ghamdi
Time	07:00	08:00	08:00	09:00	10:00	09:00	11:00	13:10	11:00	10:00	09:00
Tick											

Student's Name :

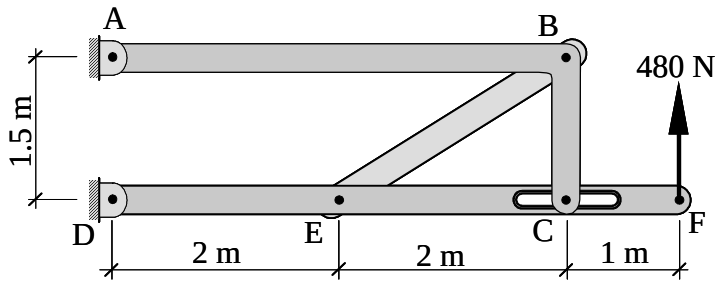
Student's ID :

Problem	Assigned Grade	Earned Grade
1	25 (Points)	
2	20 (Points)	
3	20 (Points)	
4	20 (Points)	
5	15 (Points)	
Total	100 (Points)	

Good Luck

Problem 1 (25 Points)

The three-member frame shown in the below figure, is supported at A and D by pins. Member ABC is connected to member DECF by a pin at E and a smooth slot at C. Determine all forces acting on member DECF.



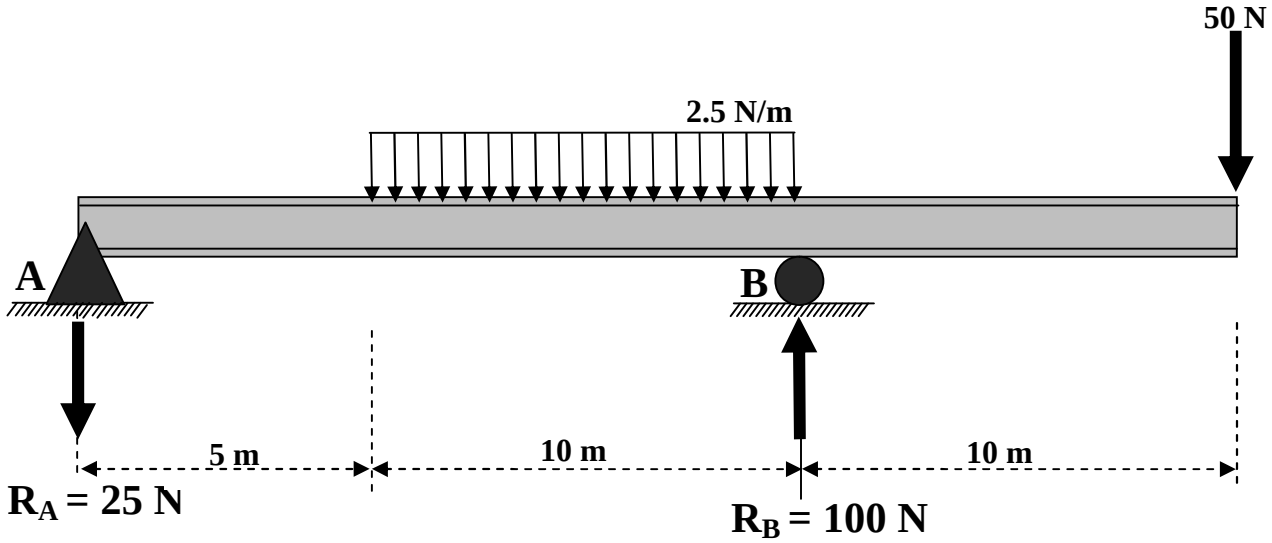
Problem 2 (20 Points)

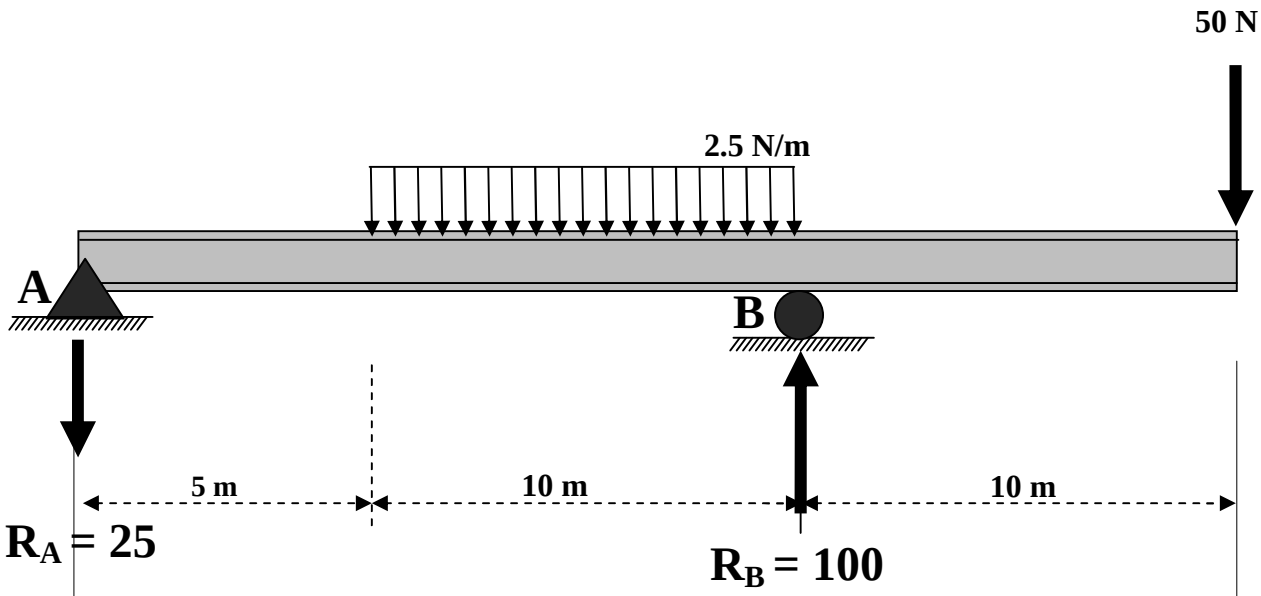
For the beam shown below:

(12 Points) 1) Determine the equations for the shear force and bending moment.

(8 Points) 2) Draw the shear force and bending moment diagrams.

The reactions at the supports A and B (R_A and R_B) are given. Develop the equations on this page, and draw the diagrams on page 6.



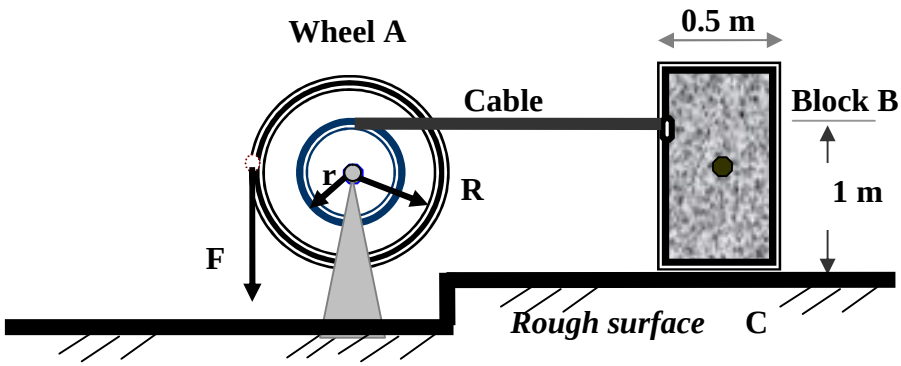

50 N
2.5 N/m
A
B
5 m
10 m
10 m
$R_A = 25$
$R_B = 100$

Problem 3 (20 Points)

A wheel **A** (with radius **R** of 0.5 m) may be rotated freely on the given stand and has an in-extensible cord wrapped around its internal spool (with radius **r** = 0.25 m) while the other end of the cable is connected to a homogeneous block B that rests on a rough surface C, as shown in the Figure. Assuming wheel A to have negligible mass, block B mass M_B = 15 kg, and μ_C = 0.30:

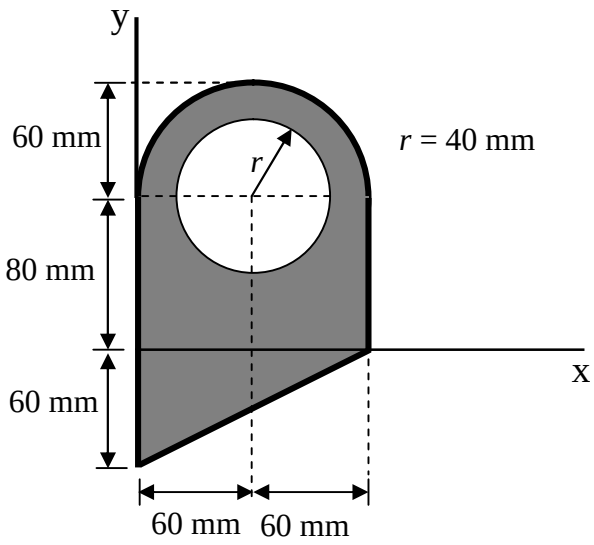
(10 Points) 1. Determine the magnitude of force F required to cause block motion to be impending.

(10 Points) 2. Determine the magnitude of force F to cause tipping of block B.



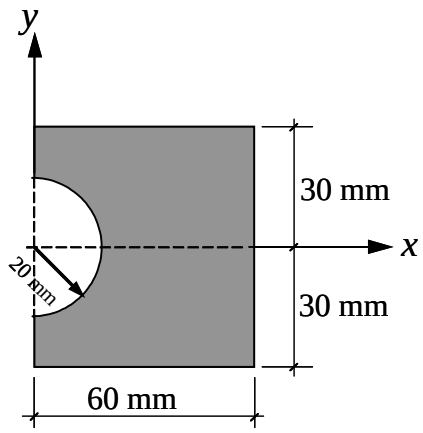
Problem 4 (20 Points)

Find the location of centroid of the shaded area shown below. **Present your calculations in a table**.

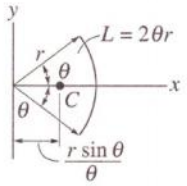
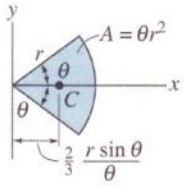
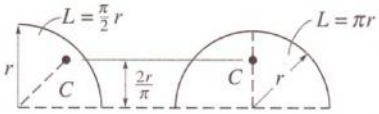
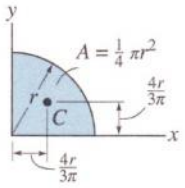
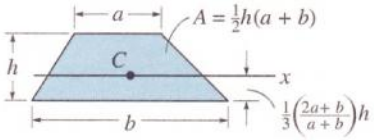
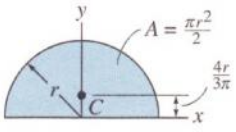
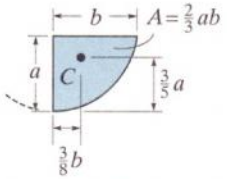
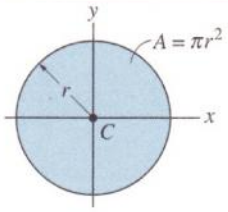
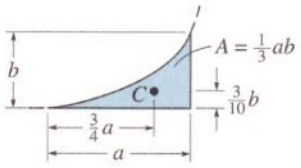
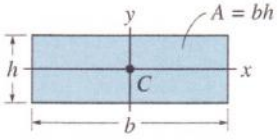
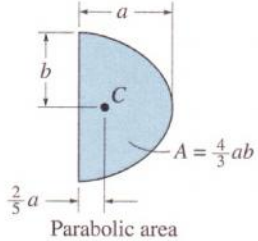
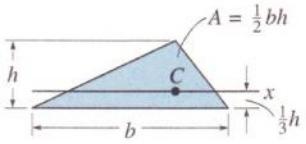


Problem 5 (15 Points)

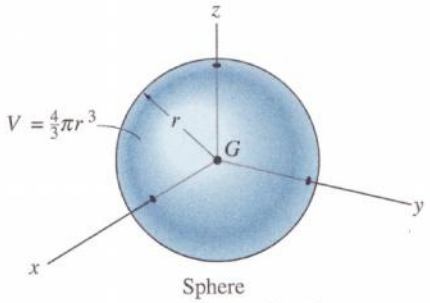
Determine the moment of inertia of the composite area with respect to the y-axis.



Geometric Properties of Line and Area Elements

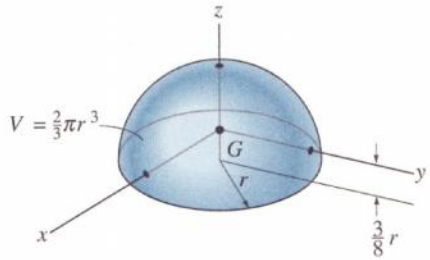
Centroid Location	Centroid Location	Area Moment of Inertia
 Circular arc segment	 Circular sector area	$I_x = \frac{1}{4}r^4(\theta - \frac{1}{2}\sin 2\theta$ $I_x = \frac{1}{4}r^4(\theta + \frac{1}{2}\sin 2\theta$
 Quarter and semicircle arcs	 Quarter circle area	$I_x = \frac{1}{16}\pi r^4$ $I_y = \frac{1}{16}\pi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

Center of Gravity and Mass Moment of Inertia of Homogeneous Solids



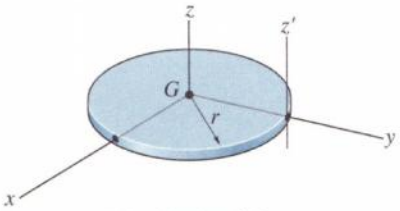
Sphere

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



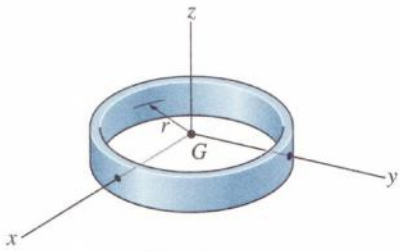
Hemisphere

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



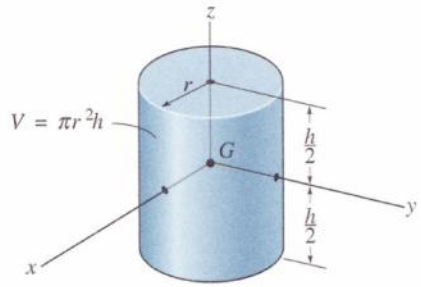
Thin Circular disk

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



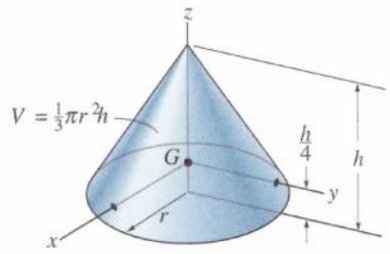
Thin ring

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



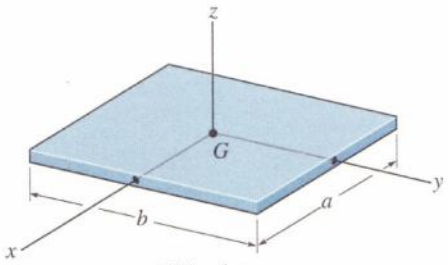
Cylinder

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



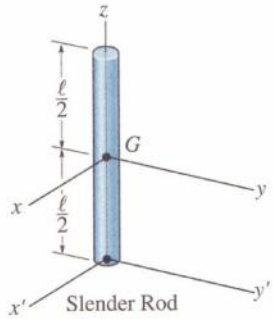
Cone

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



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

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