King Fahd University of Petroleum & Minerals

Department of Civil and Environmental Engineering

CE 201 – Statics

Semester: 151
Examination: Final
Date (Day): December 21, 2015 (Monday)
Time: 07:00 – 10:00 p.m.

Section	1	2	3	4	5	6	7	8
Instructor	Al-Malack	Al-Malack	Vohra	Al-Osta	Al-Attas	Essa	Al-Amoudi	Chowdhury
Time	07:00	08:00	08:00	09:00	10:00	11:00	13:10	07:00
Tick								

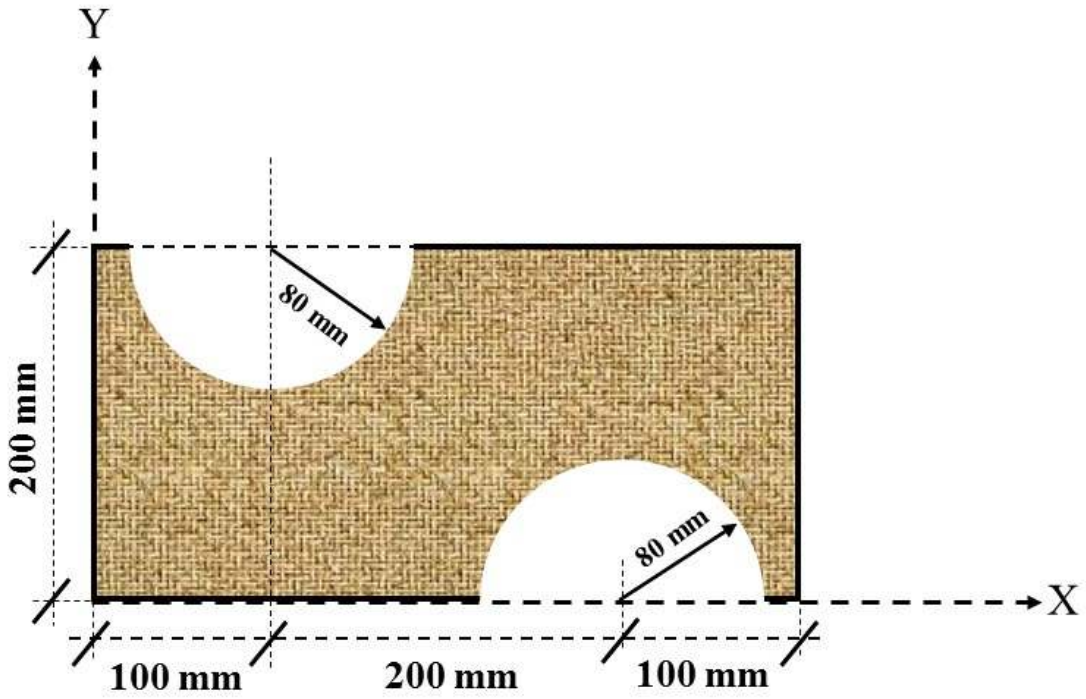
Student's Name :	
Student's ID :	

Problem	Assigned Grade	Earned Grade
1	10 (Points)	
2	25 (Points)	
3	25 (Points)	
4A	10 (Points)	
4B	05 (Points)	
5A	15 (Points)	
5B	10 (Points)	
Total	100 (Points)	

Good Luck

Problem 1 (10 Points)

For the area shown below, determine the moment of inertia about the x-axis (I_X). **Please use the table given below.**



Problem 2 (25 Points)

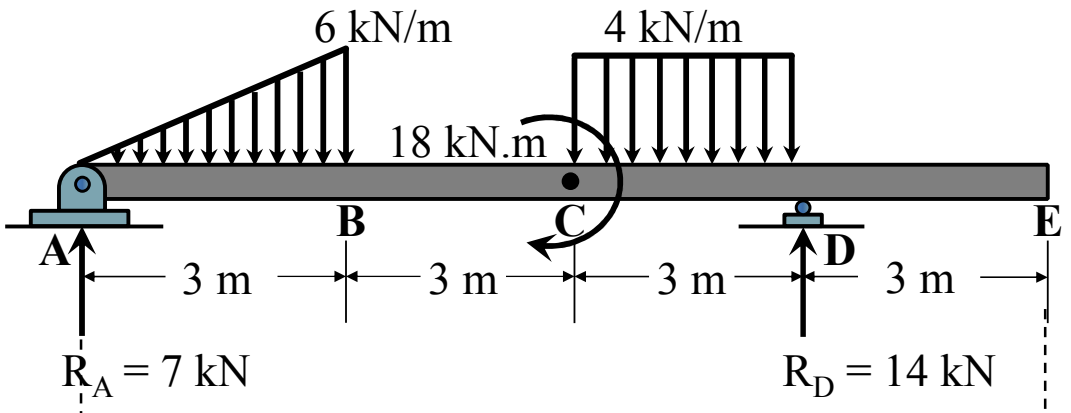
Draw the shear force and moment diagrams for beam **ABCDE** shown below. In the diagrams, you have to indicate the following:

(i) Maximum and minimum values of shear force and moment in each segment; and

(ii) The degree of each curve on both diagrams.

(Note: R_A and R_D are reactions of the pin at A and roller at D, respectively).

USE THIS PAGE TO DRAW THE DIAGRAMS.



Problem 3 (20 Points)

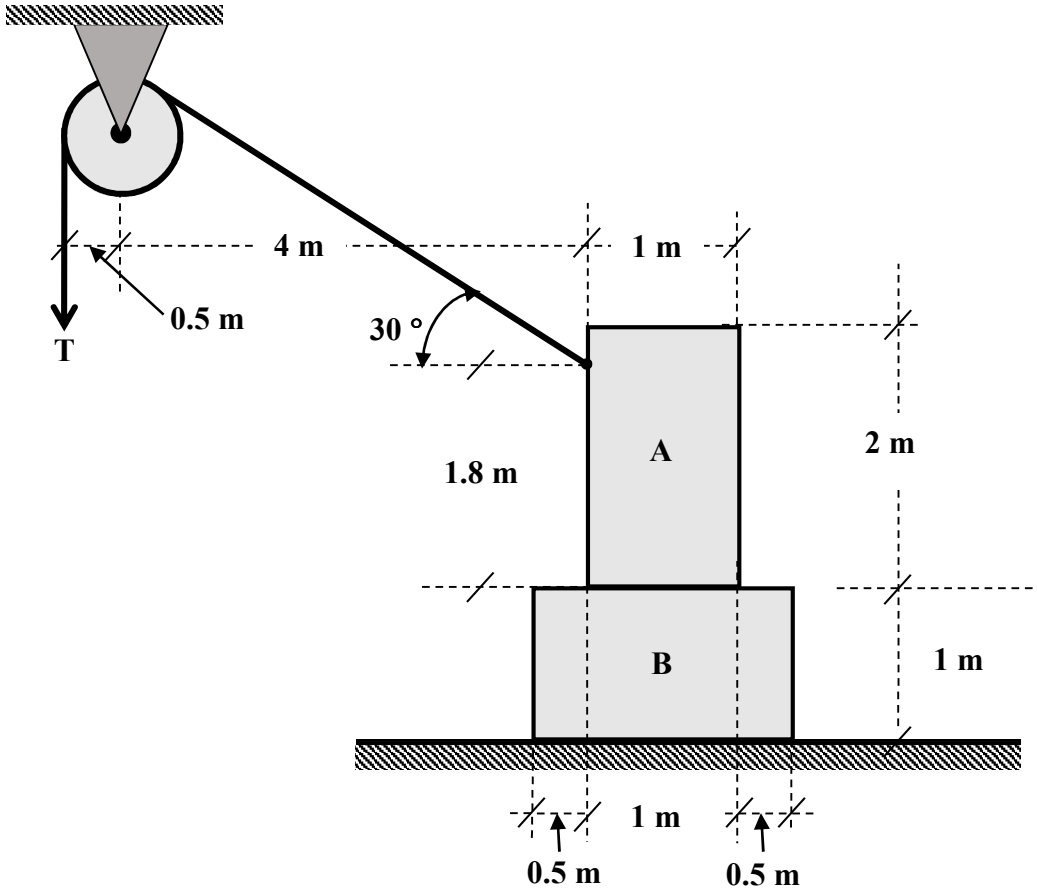
Given the below information, what will be the maximum T that can be applied without causing motion of the blocks system:

Mass of the homogeneous Block A; $\mathbf{m_A}$ = 30 kg

Mass of the homogeneous Block B; $\mathbf{m_B}$ = 50 kg

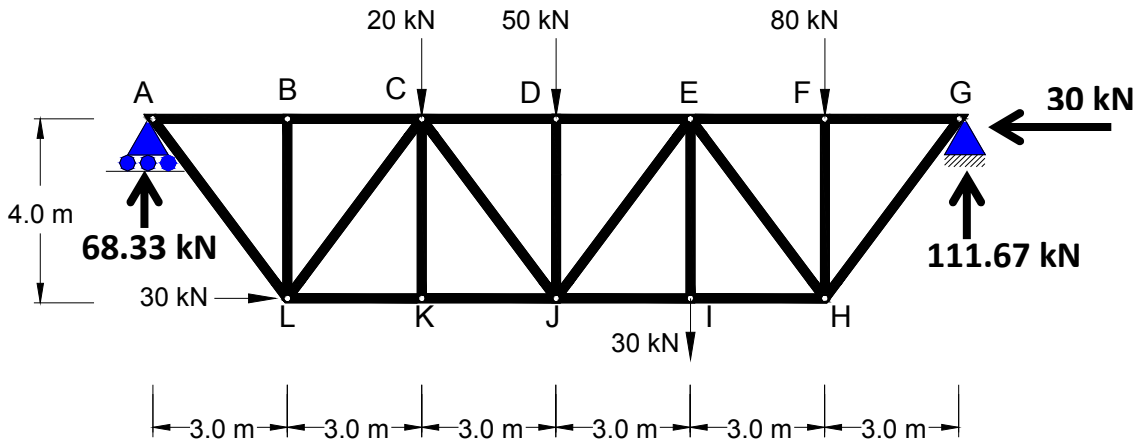
Friction Coefficient between Blocks A and B; $\boldsymbol{\mu_{AB}}$ = 0.3

Friction Coefficient between Block B and the Surface; $\boldsymbol{\mu_B}$ = 0.15



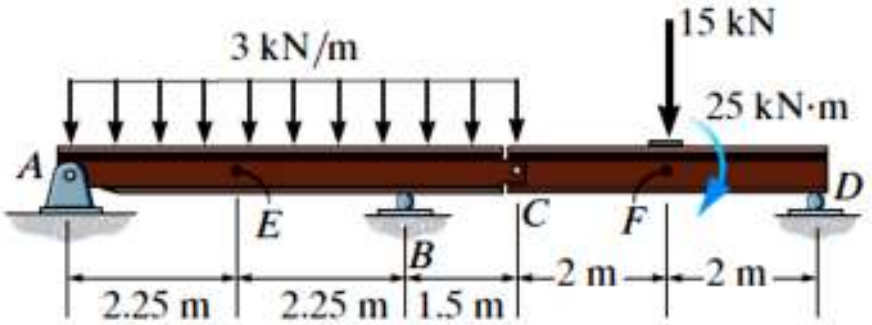
Problem 4-A (10 Points)

In the truss shown below, determine the force in members **CL, LK and BC** of the truss **Using the Method of Joints**. Indicate whether the members are in tension or compression. **Reactions of supports at A and G are given**.



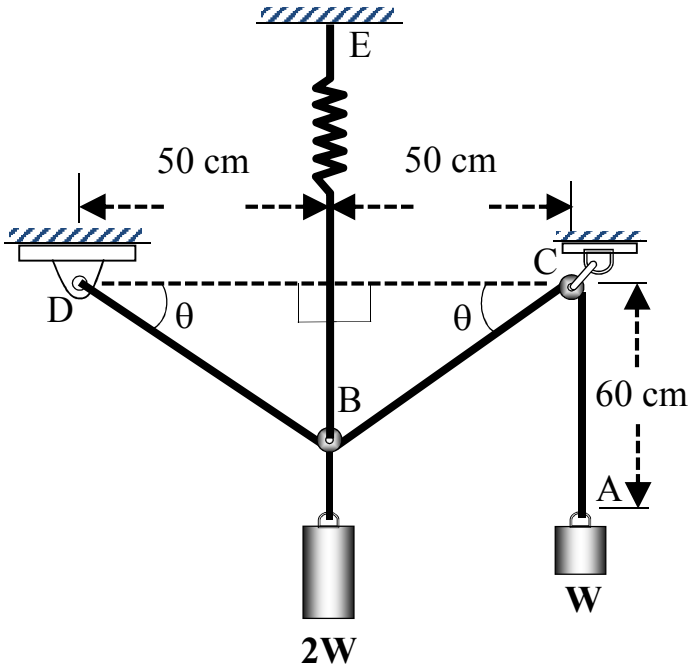
Problem 4-B (5 Points)

In the beam shown below, replace the force and couple system acting on the beam by an equivalent resultant force and couple moment acting at point A. **Show all solution steps**.



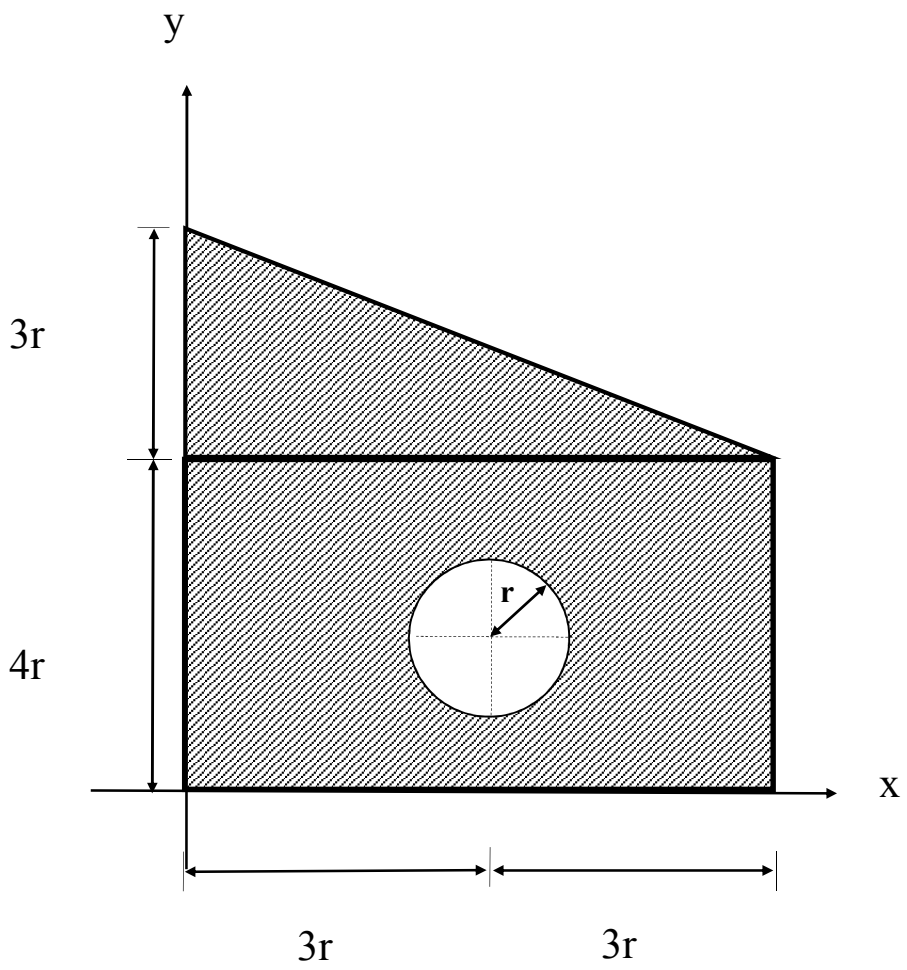
Problem 5-A (15 Points)

Determine the value of weight W (in N) if after stretch of spring BE the angle θ is 5°. The cable **BCA** passes over a frictionless pulley at C. Before adding the weight (2W) at ring B, point B was located mid-way on the line connecting points C and D.

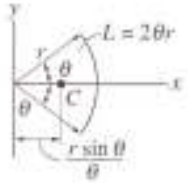
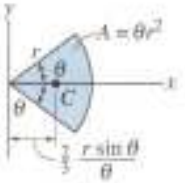
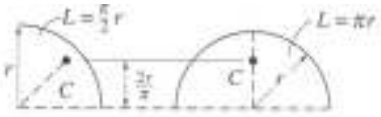
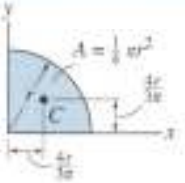
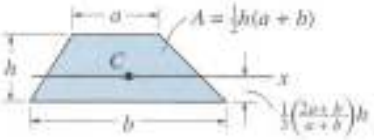
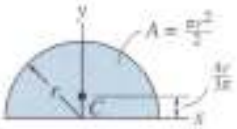
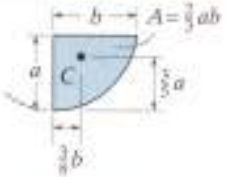
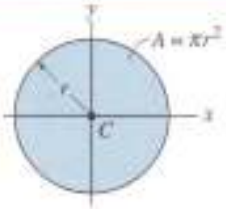
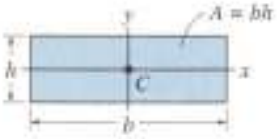
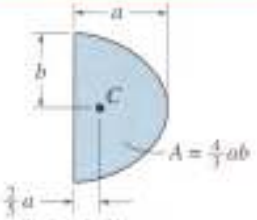
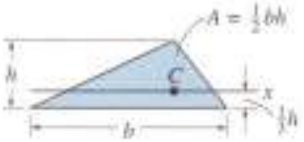


Problem 5-B (10 Points)

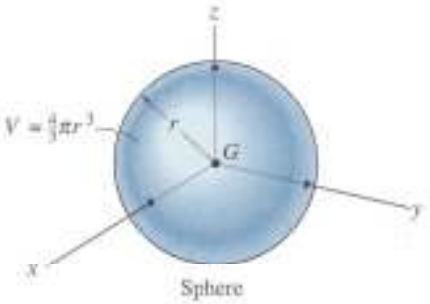
Locate the centroid of the shaded area given below considering r = 10 cm. **Please use the table given below.**



Geometric Properties of Line and Area Elements

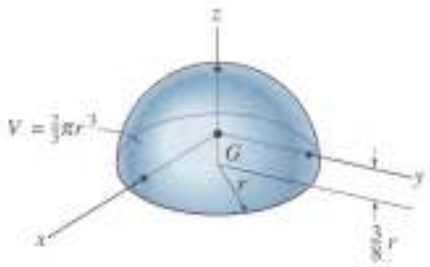
Centroid Location	Centroid Location	Area Moment of Inertia
 Circular arc segment	 Circular sector area	$I_x = \frac{1}{4}r^4(\theta - \frac{1}{2}\sin 2\theta$ $I_y = \frac{1}{4}r^4(\theta + \frac{1}{2}\sin 2\theta$
 Quarter and semicircle arcs	 Quarter circle area	$I_x = I_y = \frac{1}{16}\pi r^4$ $I_{x'}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



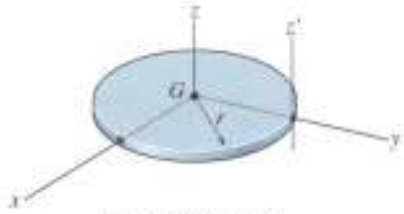
Sphere

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



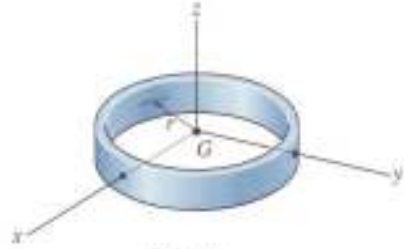
Hemisphere

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



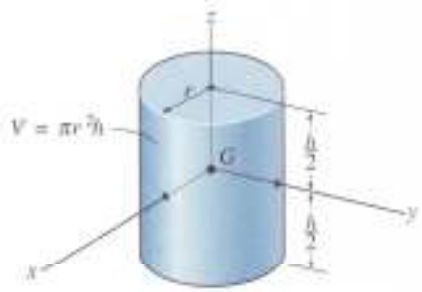
Thin Circular disk

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



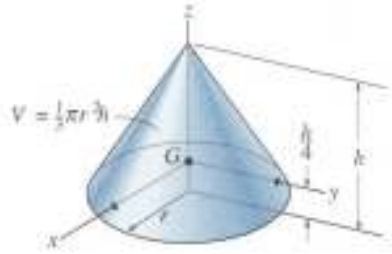
Thin ring

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



Cylinder

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

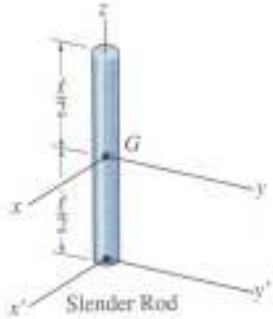


Cone

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

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

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