Universtié d'Ottawa
Faculté de génie

Departement de
génie civil

University of Ottawa
Faculty of Engineering

Civil engineering
Department

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GNG 1105
ENGINEERING MECHANICS

Final examination
13 December 2010
Profs. Skaff, Van Blaeren and Flores-Vera

Time: 3 hrs
Page 1 of 2

Closed Book Exam. Programmable calculators are not allowed.
Free-body diagrams must be drawn where appropriate.

Problem 1 (16/60)
Mast ABC is being supported by a ball-and-socket joint at base A and by three cables BE, BG and CD as shown.
a) Draw the free-body diagram for mast ABC
b) Write the tensions in cables BE, BG and CD in vector form.
c) If the tension in cable CD is 500 N, determine the tensions in cables BE and BG.
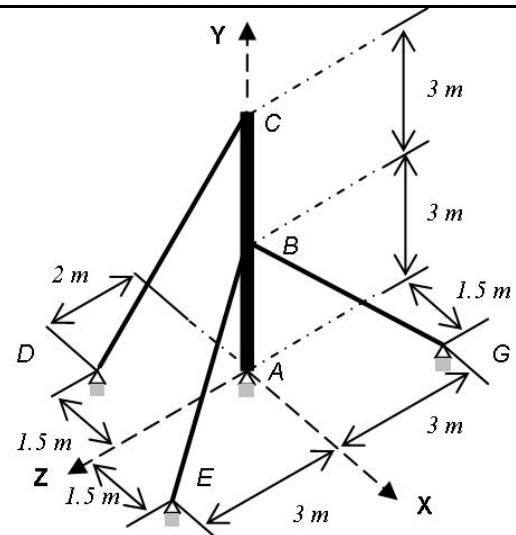
Problem 2 (11/60)
For the truss shown and assuming all joints are pinned,
a) Calculate the reactions at supports A & E.
b) Determine the forces in members CD, GD and GF using the method of sections. State whether each member is in tension or compression.
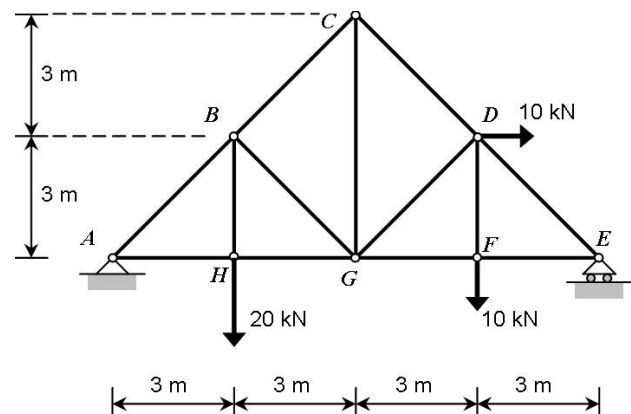
Problem 3 (11/60)

Two boxes are hanging from the frame to the right. The mass of each of the boxes is 30 Kg.
a) Determine the reactions at the supports A and E.
b) Determine all the forces acting on member ABC.
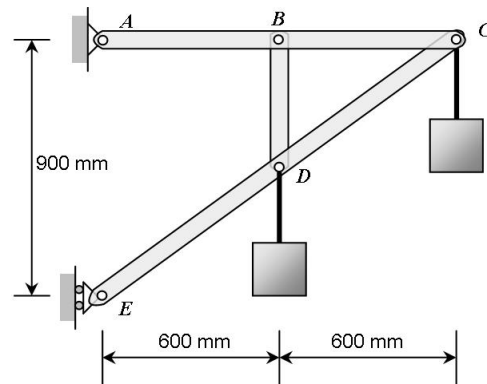
Problem 4 (11/60)

To level a wood deck, wood wedges A&B are placed under a corner of the deck. Wedge B rests on a wood board as shown, and a bar clamp is used to apply equal an opposite forces to the wedges. Knowing that $\theta=18°$ and that the coefficient of static friction between all wood surfaces is 0.35 and between the board and the ground is 0.6, determine the magnitude of **P** of the clamping forces for which upward motion of the deck is impending.
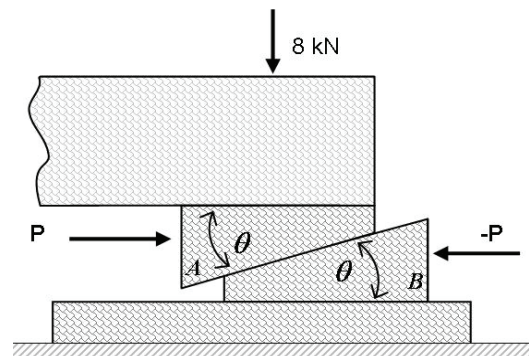
Problem 5 (11/60)

A projectile is fired from point A, located at $h_0 = 2m$ above the ground, with an initial velocity v_0 and at an angle $\alpha=50°$.
(a) What should be the minimum value of v_0 for the projectile to clear the wall if its height is H=5 m?
(b) For the value of v_0 obtained in part (a), determine the distance L that separates point A and the wall.
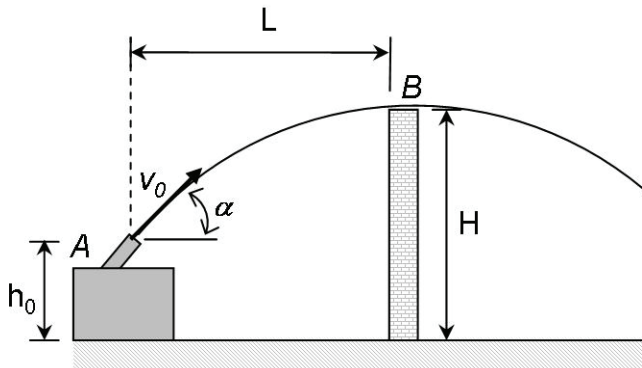
Answers

Problem 1:
$T_{BE} = (T_{BE}/4.5)(1.5i -3.0j +3.0k)$
$T_{BG}= (T_{BG}/4.5)(1.5i -3.0j-3.0k)$
$T_{CD}= (T_{CD}/6.5)(-1.5i-6.0j+2.0k)$
$T_{BG}=576.25N$
$T_{BE}=113.75N$

Problem 2:
$A_x=-10kN$; $A_y = 15kN$; $E_y=15kN$
$F_{GF}=15kN$ (T); $F_{CD}=7.07kN$ (C); $F_{DG}=F_{GD}=0$

Problem 3:
$E_x=588.6N$; $A_x=-588.6N$; $A_y=588.6N$
$F_{BD}=-1177.2N$; $C_x=588.6N$; $C_y=882.9N$

Problem 4:
$P=8.89kN$

Problem 5:
$v_o=10$ m/s ; $t=0.78s$
$L=7.8m$