THE UNIVERSITY OF CALGARY
Schulich School of Engineering

ENGG 202 – Engineering Statics
First Midterm Exam
February 13, 2013 (Wednesday)
19:00 – 20:30 (90 minutes)

1. The examination is closed textbook
2. There are 4 short answer questions and 2 comprehensive questions. Answer all questions directly on the question sheets. For the short answer questions, write your answer in the space provided, only the answer will be marked. You may write on the back of the page.
3. Only the SSE sanctioned, non-programmable, scientific calculator is permitted.
4. **Free body diagrams are required** on all equilibrium questions to obtain full marks. Diagrams must be separate from the given figure.

DO NOT OPEN THE EXAM BOOKLET UNTIL INSTRUCTED TO DO SO

Student's Last name: _____

Student's First name: _____

Lecture Section (Circle One):

L01	Tu Th	15:30	Maes
L02	Tu Th	12:30	Grozic
L03	Tu Th	11:00	Di Martino
L04	Tu Th	09:30	Lissel

Student ID#: _____

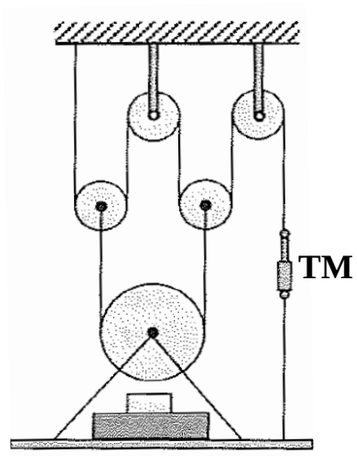
USEFUL FORMULAE:

Sine Law: $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$

Cosine Law: $c^2 = a^2 + b^2 - 2ab\cos C$

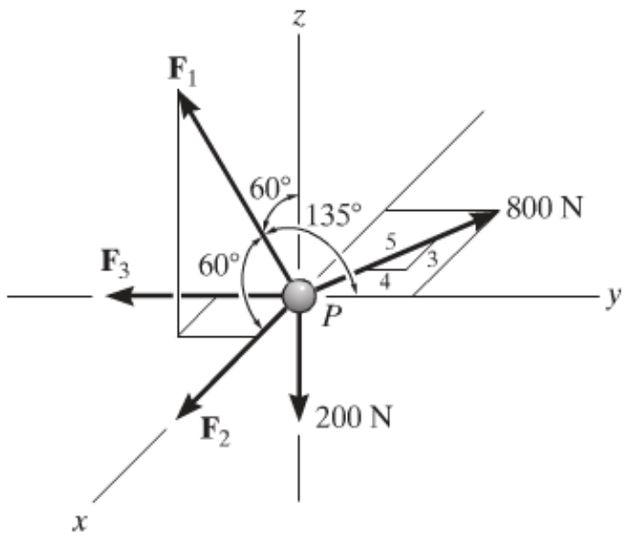
Question	Maximum mark	Mark
1 – 4	10	
5	12	
6	10	
Total	32	

Q1. A heavy mass is carried by a system of cables and mass-less frictionless pulleys. A tension meter (TM), used to measure the force in the cable, is applied to one of the cables of the system as shown below. For the equilibrium position shown, the TM measures a force of 2.30 kN. Determine the mass.



ANSWER: m = _____ kg /2 marks

Q2. The magnitudes of the forces are F_1=1200 N, F_2=800 N, and F_3=220 N:
(a) Determine the resultant force $\mathbf{F_R}$ *of all 5 forces*, express your answer in Cartesian vector format.
(b) What is the magnitude of $\mathbf{F_R}$?
(c) What are the coordinate angles of $\mathbf{F_R}$?

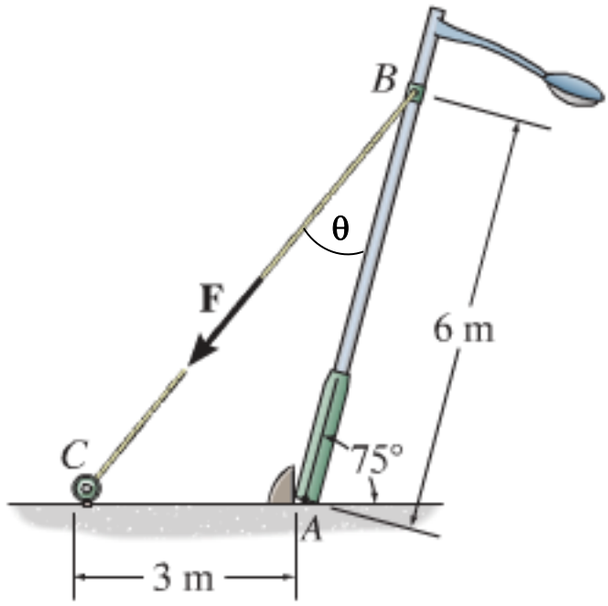


ANSWER: $\mathbf{F_R}$ = _____ N /2 marks

$|\mathbf{F_R}|$ = _____ N /1 mark

$\theta_x, \theta_y, \theta_z$ (α,β,γ) = _____ /1 mark

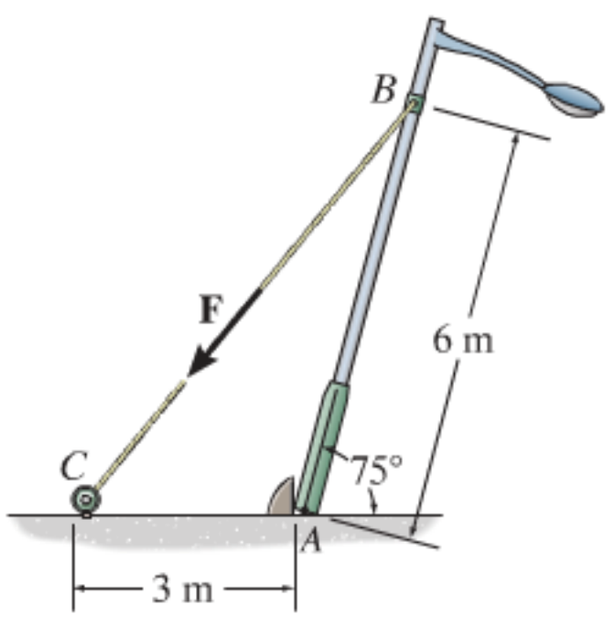
Q3. Determine the direction θ ($0 \leq \theta \leq 180^{o}$) of the 100 N force **F** so that **F** produces (a) the maximum moment about point A and (b) the minimum moment about point A.



ANSWER: (a) θ for max. moment = _____ /1 mark

(b) θ for min. moment = _____ /1 mark

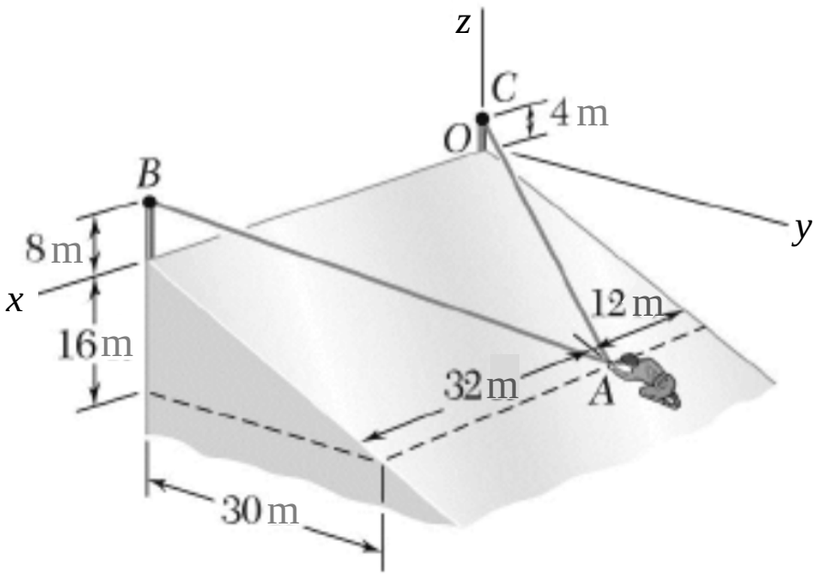
Q4. In order to raise the lamp post from the position shown, the force **F** in the cable BC must create a counterclockwise moment of 1750 N·m about point A. Determine the magnitude of the force that must be applied to the cable.



ANSWER: F = _____ N /2 marks

Q5. A 78.5 kg mountaineer is stuck on the slope of a (slippery) glacier, and is using *two different* ropes AB and AC to maintain a precarious position of static equilibrium.
Assume that the force exerted on the mountaineer by the icy surface is perpendicular to that surface.
Determine the magnitudes of the tension in ropes AB and AC, and the magnitude of the normal force.

/12 marks



Q6. A force F = 180 N is applied to the hinged door at point A. Point B lies in the *x*-*z* plane.
(a) Determine the moment of the force **F** about the origin, point O. Express your answer in Cartesian vector format.
(b) Determine the magnitude of the moment produced by force **F** about the hinged axis (the *x* axis) of the door.

/10 marks