

THE UNIVERSITY OF CALGARY
Schulich School of Engineering

ENGG 202 – Engineering Statics
Second Midterm Exam
March 24, 2011 (Thursday)
18:30 – 20:00 (90 minutes)

1. The examination is closed textbook
2. There are 6 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.
3. Only the SSE sanctioned, non-programmable, scientific calculator is permitted.
4. Free body diagrams are required on all comprehensive equilibrium questions to obtain full marks.

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	13:00	Lissel
L02	Tu Th	11:00	Grozic/Lissel
L03	Tu Th	09:30	Grozic

USEFUL FORMULAE:

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

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

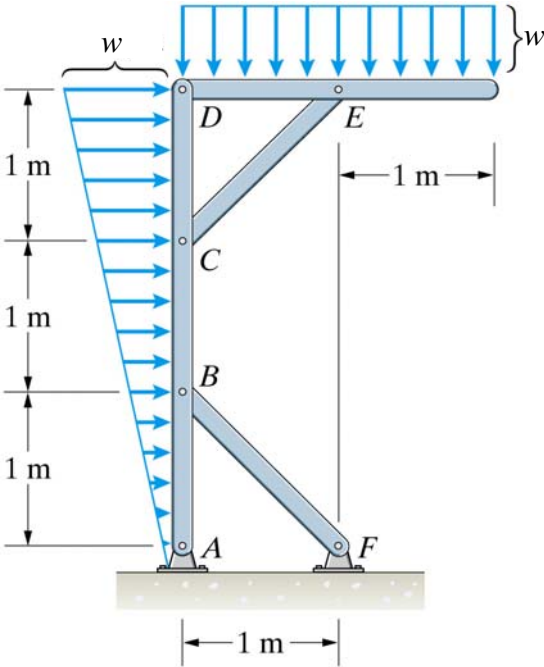
Question	Maximum mark	Mark
1 – 6	14	
7	15	
8	15	
Total	44	

All figures modified from:
“Engineering Mechanics, Statics”, 5th Edition in SI Edition, Bedford and Fowler, Prentice Hall, 2008.

Q1. The frame below is subjected to the distributed loads shown, and the magnitude $w = 2 \text{ kN/m}$.

(a) Replace the system shown by an equivalent force-couple system at A. Express your answers in Cartesian vector format.

(b) Replace the system shown by a single equivalent force. Where does the line of action of this force intersect the member $ABCD$ (measured from A)?

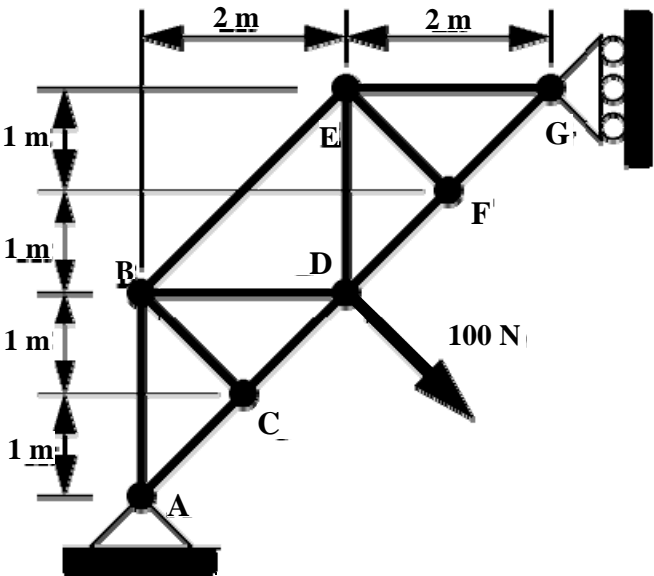


ANSWER: $\mathbf{F} = \underline{\hspace{2cm}} \text{ kN}$ /1 mark

$\mathbf{M} = \underline{\hspace{2cm}} \text{ kN}\cdot\text{m}$ /1 mark

$y = \underline{\hspace{2cm}} \text{ m}$ /1 mark

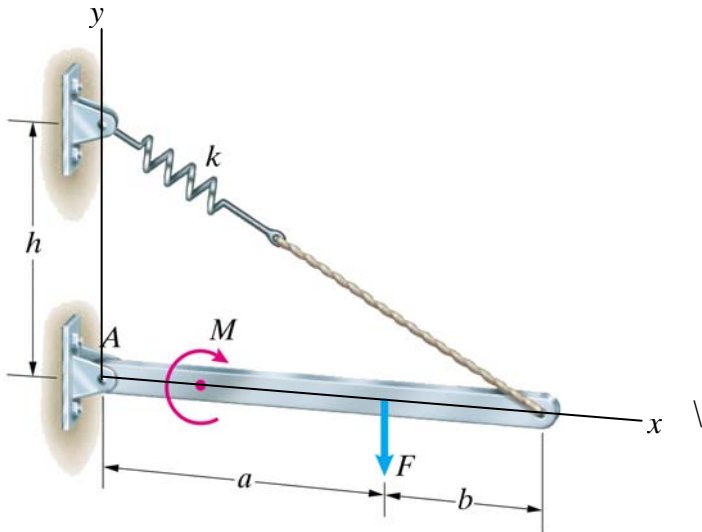
Q2: The truss shown below is supported by a roller at G and a pin at A. For the loading showing, identify any zero force members.



NOTE This question will be marked right-wrong.

ANSWER: $\underline{\hspace{2cm}}$ /1.5 marks

Q3. The dimensions $a = 2$ m and $b = 1$ m. The couple $M = 2400$ N·m. The spring constant, k , is 6000 N/m. With the beam in the horizontal position shown, the spring is unstretched if $h = 0$ and the system is in equilibrium when $h = 2$ m. For equilibrium, determine the magnitude of the force \mathbf{F} and the magnitude and direction of the horizontal and vertical components of the reaction at A.

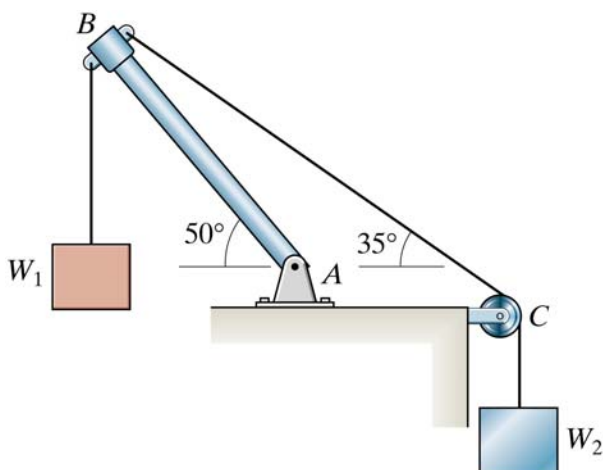


ANSWER: $F =$ _____ N /1.5 marks

$A_x =$ _____ N /1 mark

$A_y =$ _____ N /1 mark

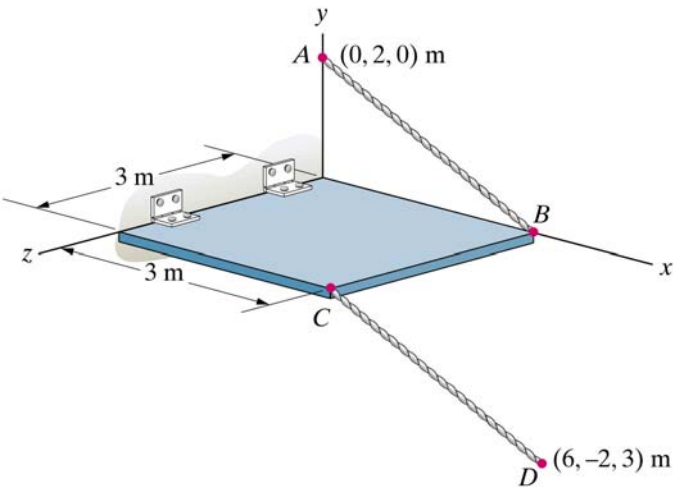
Q4. The weight $W_1 = 1000$ N and the bar AB weighs 50 N. The cable goes over a pulley at C. For the equilibrium position shown, draw the FBD(s) that would be required to determine the weight W_2 and the reaction at the pin support A. Do not perform any calculations.



ANSWER (draw in the space below):

/2.5 marks

Q5: The plate shown is contained within the x - z plane. The cables AB and CD lie within parallel x - y planes. The tension in each cable is 50 N. Determine the moment exerted on the plate by the two cables. Express your answer in Cartesian vector format.



ANSWER: **M** = _____ N·m /2 marks

Q6. Considering only the member labelled AB , indicate whether it is a 2-force member, 3-force member, or neither, by circling your choice under each of the following figures. Assume that the magnitudes of P , w , and M are known.

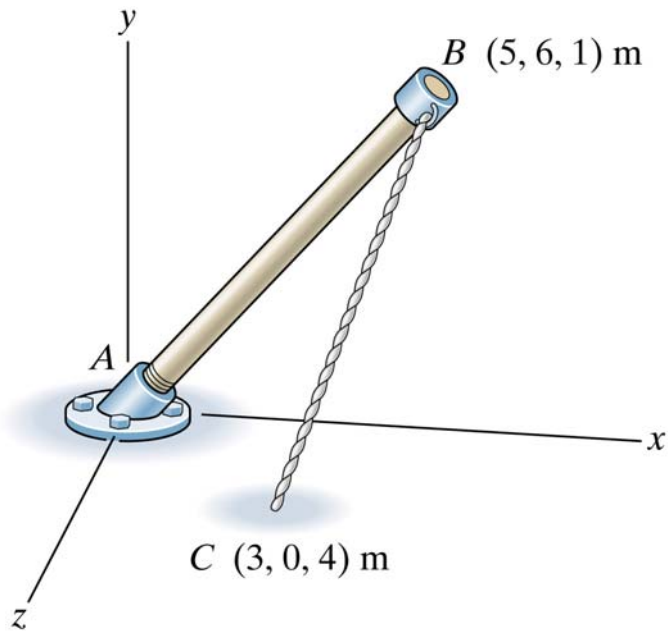
2-force/3-force/neither	2-force/3-force/neither	2-force/3-force/neither
2-force/3-force/neither	2-force/3-force/neither	2-force/3-force/neither

/1.5 marks

Q7. The bar AB has a fixed support at A. The collar at B is fixed to the bar. Neglect the weight of bar AB.

- (a) If the magnitude of the moment reaction exerted at A should not exceed $100 \text{ kN}\cdot\text{m}$, what is the largest allowable tension in the rope BC?
- (b) If the tension in rope BC is 40 kN , what are the reactions at support A in Cartesian vector format?

/15 marks



Q8. The truss shown below is supported by a pinned connection at H and a roller at I . For the loading shown, determine the forces in members AB , AC , DF , EF , and EG and state whether they are in tension or compression.

/15 marks

