THE UNIVERSITY OF CALGARY
Schulich School of Engineering

ENGG 202 – Engineering Statics
First Midterm Exam
February 16, 2012 (Thursday)
19:00 – 20:30 (90 minutes)

1. The examination is closed textbook
2. There are 5 short answer questions and 3 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 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	15:30	Raaflaub
L02	Tu Th	12:30	Anglin
L03	Tu Th	11:00	Lissel
L04	Tu Th	09:30	Grozic

USEFUL FORMULAE:

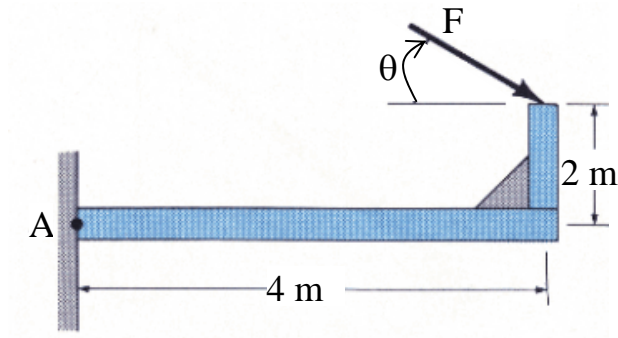Sine Law: $\dfrac{\sin A}{a} = \dfrac{\sin B}{b} = \dfrac{\sin C}{c}$

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

Question	Maximum mark	Mark
1 – 5	12	
6	5	
7	6	
8	12	
Total	35	

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

Q1. Determine the direction θ (0 ≤ θ ≤ 180°) of the 40 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 = _____   /1 mark

(b) θ = _____   /1 mark

Q2. The mass of bar AB is negligible compared to the mass of the suspended object E. The bar exerts a force at B that points from A toward B. The mass of the object E is 200 kg. Write the 3 equations of equilibrium (including the components of all of the forces) necessary to determine the tensions in cables BC and BD and the force in bar AB. Do NOT solve the equations.
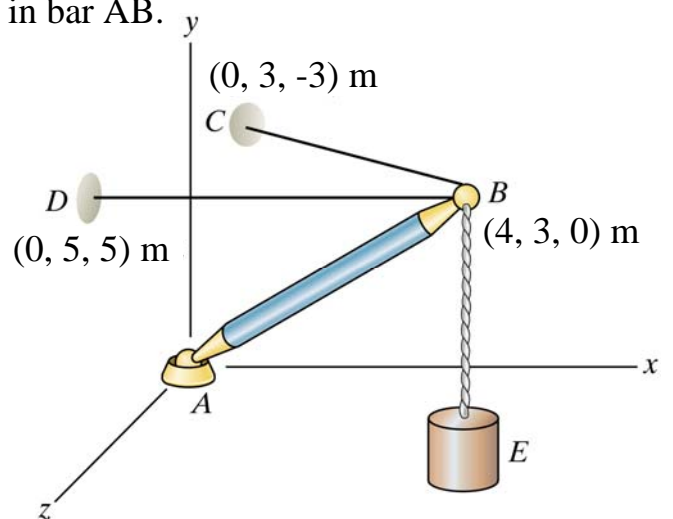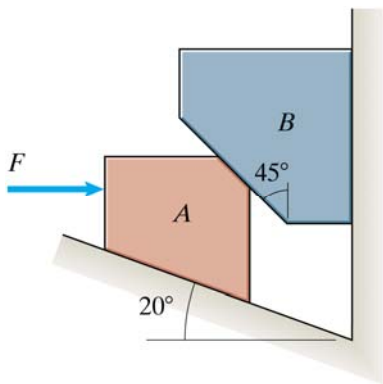

ANSWER: Eq. 1 _____   /1 mark

Eq. 2 _____   /1 mark

Eq. 3 _____   /1 mark

3

Q3. The mass of block A is 42 kg, and the mass of block B is 50 kg. The surfaces are smooth (i.e. frictionless). Draw the FBD(s) that would be required to determine the force F (label and show direction of all forces on the FBD(s)). Do NOT perform any calculations.

ANSWER (draw in the space below):

/3.5 marks

Q4. The block shown below is held in equilibrium by the two ropes shown. If the block weighs 400 N, determine the magnitude of the tension in Ropes 1 and 2.
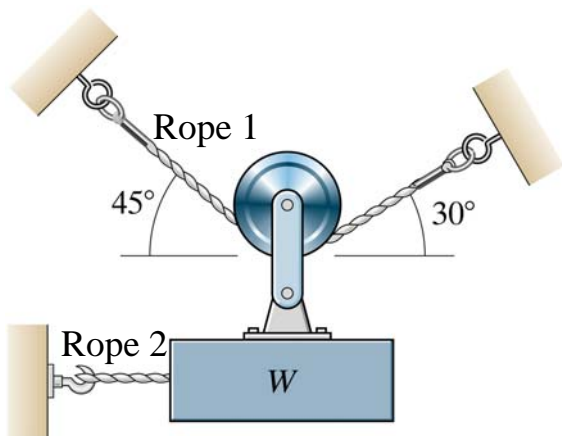
ANSWER: tension in rope 1: _____ N   /1 mark

tension in rope 2: _____ N   /1 mark

Q5. The support at the left end of the beam will fail if the magnitude of the moment about A due to the 15 kN force F exceeds 18 kNm. What is the largest allowable length of the beam so that the support does not fail?
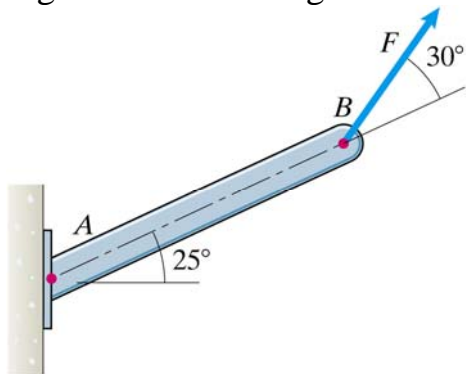
ANSWER: Max Length of AB= _____ m   /1.5 marks

4

Q6. Determine the angle, θ, between the bar BA and the rope DC. The bar is 1200 mm in length and the coordinates of point C are (300, 0, 200) mm.

/5 marks
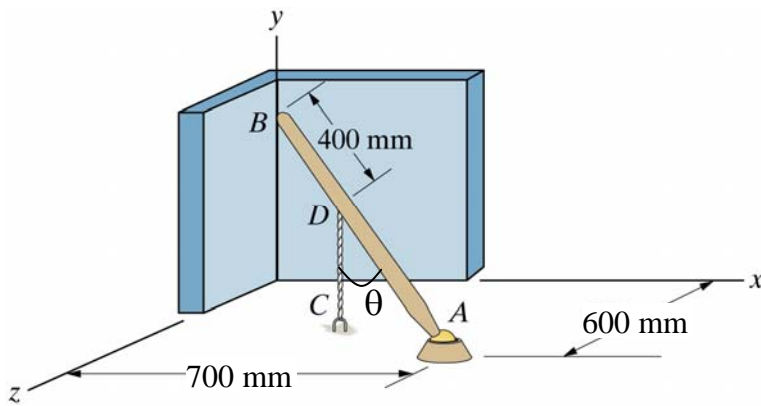
Q7. A force, F, of 30 N is required to hold the disk in the position shown. If the disk weighs 40 N and has a radius of 150 mm, then what are the normal forces acting on the disk at A and B? Indicate both magnitude and direction in your answers.

/6 marks
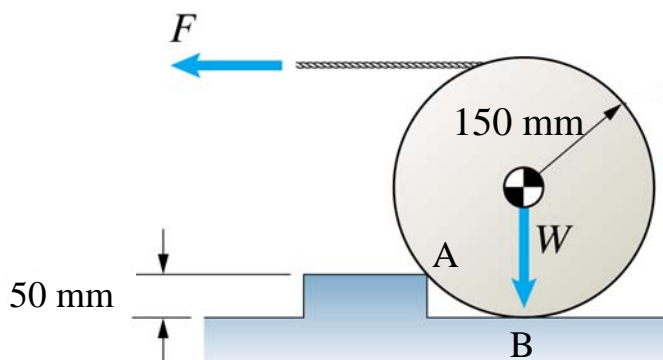
Q8. A cable extends from point C to point D. The weight of the 4 kg rectangular plate acts at the midpoint G of the plate. Point A lies in the *x-y* plane, [⬚⬚⬚⬚⬚⬚⬚⬚⬚⬚]
The sum of the moments about the straight line through the supports A and B due to the weight of the plate and the force exerted on the plate by the cable CD is zero. Neglect the thickness of the plate. Determine the tension in cable CD. Express your answer in Cartesian vector format.

/12 marks

(100, 500, 700) mm

A (100, 250, 0) mm

D

G

B

(0, 180, 360) mm

x

C (200, 55, 390) mm

y

z