Final Exam CIVE 3202 Mechanics of Solids II April 16, 2016 0900-1130	Name	
	Student Number	

General Instructions

1. Provide your name and student number on each page. Answer all questions on the examination paper provided. Cross out any work that should *not* be graded.
2. The exam is closed notes and will be marked out of 50, which will count towards 50% of your final grade. The question value is provided in the [#] brackets.
3. Only non-programmable calculators are permitted.
4. A formula sheet is provided.

Question 1 [4 marks]

Answer the following questions in the space provided. Each question is worth 1 marks.

Question	Answer
A composite beam is made of two materials, identify the sentence that best describes the stress distribution in the composite beam? A. The stress distribution magnitude varies across the two materials. B. The stress distribution has the same magnitude across the two materials. C. The non-linear stress distribution is due to the varied strain across the two materials. D. The stress distribution of the transformed beam is 2/3 of the stress distribution of the original section. E. There are no stresses induced in a composite beam since the stresses from each material cancel each other out. F. Sentences A and C	
What is true about the shear flow distribution in thin-walled members? A. q varies parabolically along segments perpendicular to the shear force V. B. q varies parabolically along segments parallel to the shear force V. C. q has a constant distribution along all segments of the cross-section. D. q has a parabolic distribution along the flange and web of the cross-section. E. q has a linear distribution along the flange and web of the cross-section.	
What does the shear centre of an open thin-walled member represent? A. The location where the shear flow along the cross-section is zero. B. The location where an applied force P will cause the beam to twist without bending. C. The shear centre is the location where an applied force P will cause the beam to bend without twisting. D. A and C	
What best describes the behaviour of solid circular and solid non-circular members under torsion? A. The solid non-circular member is more efficient than an equivalent solid circular member because it is subjected to a smaller maximum shear stress and a smaller angle of twist. B. Circular and non-circular member will bulge and warp. C. The maximum shear stress of a non-circular member is always half the maximum shear stress of a solid circular member. D. The shear strain of a circular member varies linearly along all radial lines while the shear strain of square members varies non-linearly along two radial lines. E. Regardless of the shape, members with the same cross-sectional area will experience the same shear stresses and angle of twist.	

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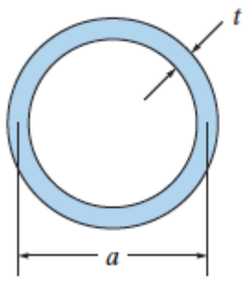
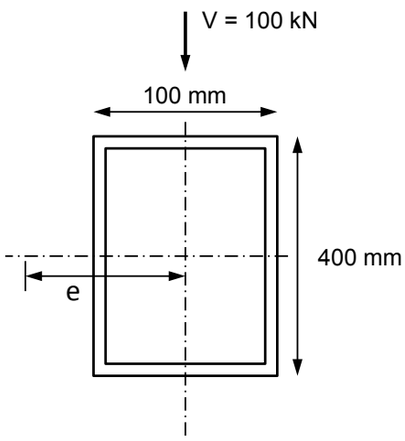
Question 2 [6 marks]
Answer the following questions in the space provided. Each question is worth 2 marks.

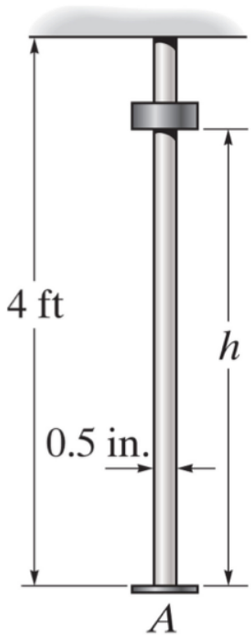
A torque T is applied to a circular tube as shown. Calculate the shear flow.



Calculate the shear center, e, for the closed, thin-walled member with a wall thickness of 10 mm and I = 167.5×10^6 mm^4.



The collar has a weight of 50 lbf. The titanium bar (E = 16,000 ksi, σ_y = 60ksi) has a diameter of 0.5 inches. Determine the maximum load developed in the bar if the weight is dropped from a height of 1 foot.



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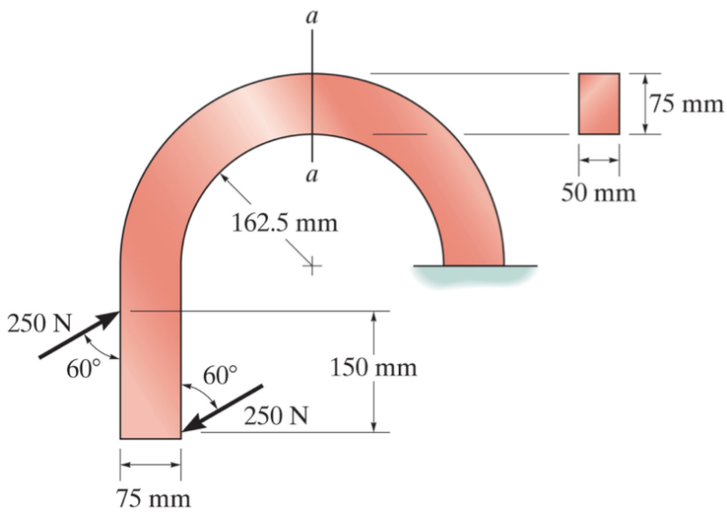
Question 3 [5 marks]

The curved bar used on a machine has a rectangular cross section. If the bar is subjected to a couple as shown,

a) determine the maximum tensile [3],
b) determine the maximum compressive stress [1],
c) sketch the stress distribution [1]

$$\int_A \frac{dA}{r} = b \ln \frac{r_2}{r_1}$$



NOTE:
In 2016 the course material covered curved beams.
This WILL NOT be assessed in the 2018 CIVE 3202 Final Exam.

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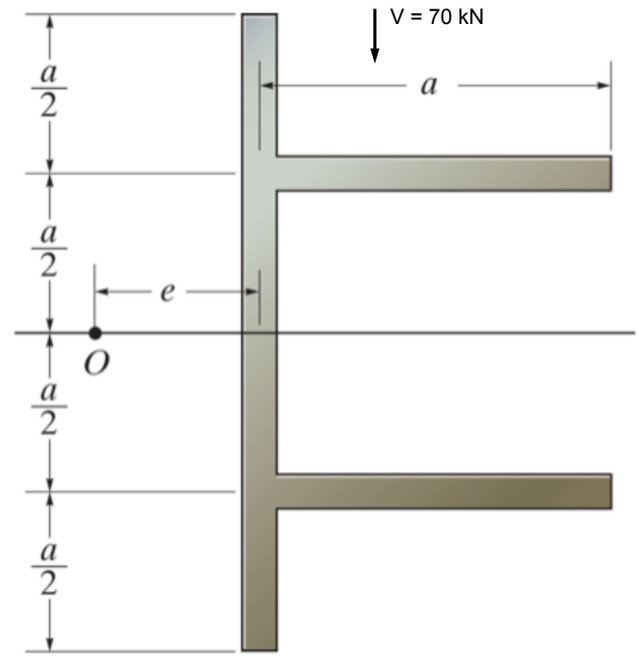
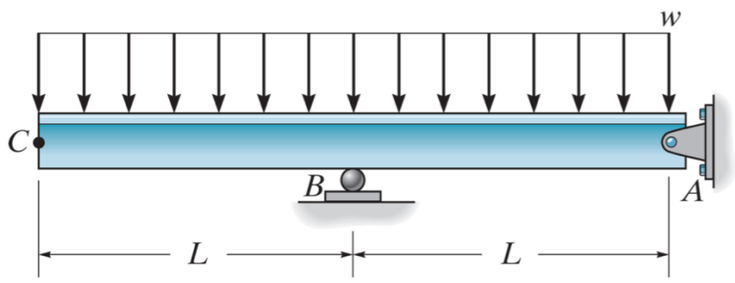
Question 4 [5 marks]

The beam is fabricated from thin plates having a thickness of t = 10 mm and dimension a = 140 mm. Determine the location of the shear center O with a vertical load V = 70 kN.



Question 5 [5 marks]

For the beam with span length L and bending stiffness EI, determine slope at B.



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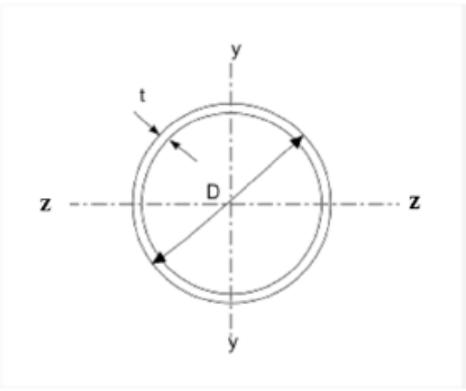
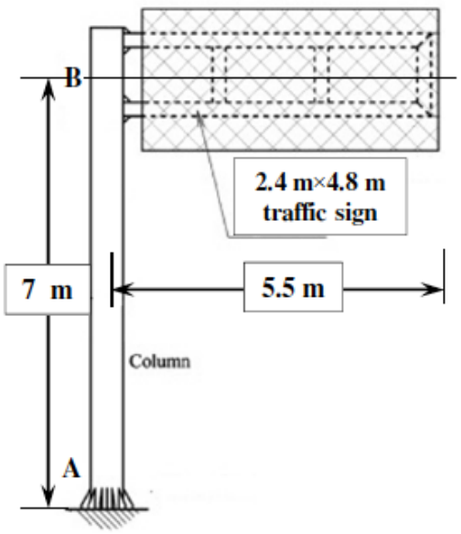
Question 6 [25 marks]

A traffic sign (2.4 m x 4.8 m) is subject to a wind load of 10 kN/m^2. The column height is 7 m with a circular tube of 450 mm diameter and 25 mm wall thickness. The mild steel yield strength is 250 MPa. From the laboratory experiments, recall for a thin walled cylinder, $\tau = \frac{VQ}{It} = \frac{VR^2t(1-\cos\theta)}{\pi R^3 t^2} = \frac{V(1-\cos\theta)}{\pi Rt}$. For the applied loads and combined stress response, determine if the column fails in yield with respect to one applicable failure theory.



Column Cross Section
(D=450 mm, t=25 mm)



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