Section: _____ Name: _____

AE 361 Applied Elasticity in Aerospace Engineering

Fall 2009

Midterm II

December 28, 2009 (5:30 pm – 7:30 pm)

You can use simple calculators as discussed in class.

Closed book exam. No notes. Formula sheet will be handed out in class.

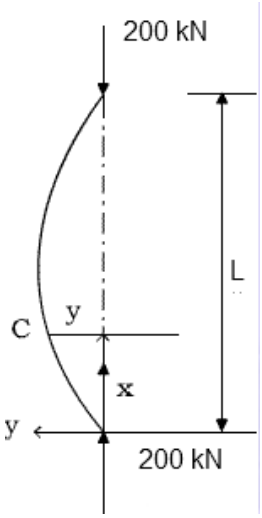
Please show all your work.

Restate the problem in your solution sheet and draw a free body diagram!

Problem 1: 20 points	_____
Problem 2: 40 points	_____
Problem 3: 40 points	_____
Total : 100 points	_____

Problem 1.

A 2-m-long pin-ended column of rectangular cross section (12mm x 6 mm) is to be made of wood. Assuming E=13 GPa, and using a factor of safety of 2.5, determine the minimum buckling load. Assume an Euler column.

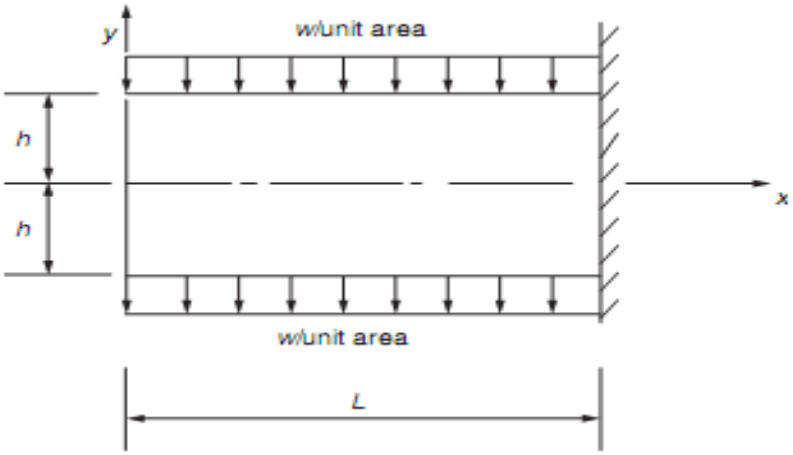


Problem 2.

The cantilever beam shown in the Figure is in a state of plane strain and is rigidly supported at x =L. Examine the following stress function in relation to this problem:

$$\phi = \frac{w}{20h^3}(15h^2x^2y - 5x^2y^3 - 2h^2y^3 + y^5)$$

Show that the stresses acting on the boundaries satisfy the conditions except for a distributed direct stress at the free end of the beam which exerts no resultant force or bending moment.



Problem 3.

A steel rod of diameter d = 50 mm (S_y = 260 MPa) supports an axial load P = 50R and vertical load R acting at the end of an 0.8-m long arm. Determine the stresses at point A and draw a schematic of the stress state at point A. Given a factor of safety n = 2, compute the largest permissible value of R using the following criteria: (a) maximum shearing stress and (b) maximum energy of distortion.