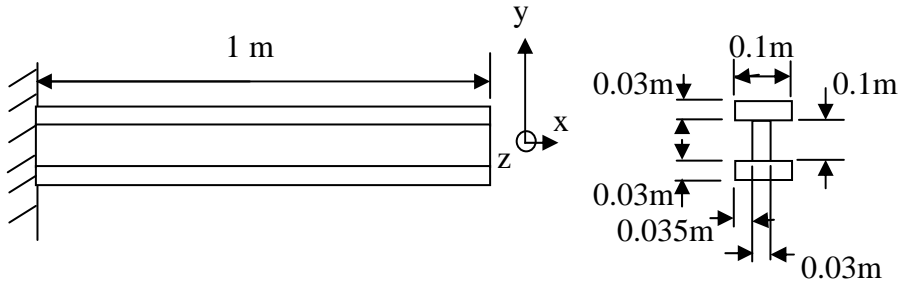
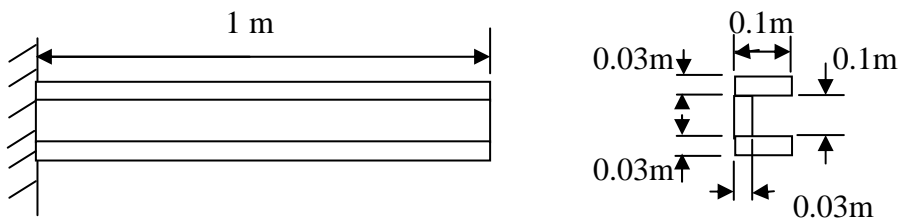


**MECH 3230**  
**Finite Element Project #1**  
**Due February 20, 2009**

- Use conventional Bernoulli-Euler Beam Theory to solve for a deflection of 1mm in the  $y$ -direction at the right end of the beam shown below. Calculate the maximum normal stress in the beam from bending and the moment applied to achieve the deflection. Assume that the beam has the following material properties ( $E=200$  GPa,  $\nu=0.3$ )



- Now use Finite Elements (ANSYS) to construct a model of the beam and calculate stress distribution and maximum stress in the beam. Use three dimensional 8 node brick elements. Apply the deflection by displacing Also document the model by providing the following:
  - A plot of the mesh used. Also list the number of elements used.
  - A plot of the deflections in the beam for the same view shown in the left diagram above.
  - A plot of the stress distribution in the beam for the same view.
- If the yield strength of the material is 100 MPa, will the beam yield?
- Rerun the same simulation for item 2 except change the material properties so that the material is elastic and perfectly plastic and yields at 100 MPa according to the von Mises yield criteria.
- Repeat part 2 for a beam with following cross section:



- Compare the results from parts 1, 2 and 5 and discuss why there are any differences in the results.