ME 354 Lab 1 Beams in Bending

This lab write-up will be in Memo format and is due one week from the date of your scheduled lab experiment. Refer to the ME354 class web site for Memo format outline.

Assignment outline:

Suppose you are given the task of evaluating two different cross section beams of the same material (6061-T6 aluminum) for reaction forces, strains, and stresses. Imagine these beams are being evaluated for two critical components of the landing gear of a large commercial airplane (350+ passengers). These components are critical to the safety of many passengers so the stress distribution throughout the cross section MUST be characterized in order to design more safely. The loading of these beams in real application is the same as the test set-up configuration in order to model the boundary conditions more precisely.

Table 1 Aluminum 6061-T6 Material Properties

Some Properties of 6061-T6 Aluminum Alloy

Elastic Modulus, E (MPa)	69000
Yield Strength (0.2%offset), S_{YP} (MPa)	275
Poisson's ratio, v	0.33
Ultimate Tensile Strength, S_{UTS} (MPa)	324
Percent Elongation, %el (50.8mm gage length)	12

Note: Ranges represent 3 standard deviations above and below a mean value

The surface strain will be measured at key locations on each beam using Uniaxial, Biaxial and Rectangular Rosette strain gages and Strain Smart—Data Acquisition System.

Things you will measure/record during the lab:

1. Beam deflections
2. Reaction load (i.e. load at the load cell / proving ring end)
3. Beam dimensions
4. Strain gage locations (don't forget to record the type and orientation of the strain gages)
5. Strain readings from the strain gages

Some things you may want to calculate:

1. Applied load and end reaction forces
2. Deflection at the applied load
3. Draw the moment and shear diagrams for each beam
4. Centroid of the beam's cross section
5. Calculate the moment of inertia for each beam cross section
6. Calculate the strain and stresses at the strain gage locations

Examples of things you could/should also cover:

1. Can you find Poisson's ratio given only the strains from gage measurements, and how does this compare with documented values for aluminum?
2. When and in what general area will the beam *fail* and why? How is failure defined?
3. On the C-Beam, can you determine the angle of rotation of the rectangular rosette on the top surface?
4. What other things can you infer/investigate that I missed/left out and why are they important?