Material for Test II

Notes: (i) The second test will be given on Thursday, November 29th, 6 PM. On Wednesday, November 28th, I will give a help session.

(ii) You would be allowed to bring one formula sheet for the Test.

1. **Strain:** You are expected to know the concept of infinitesimal strain as a point function, and the physical meaning of the normal and shear strain components. You should know how the infinitesimal strain components are related to the three displacements u, v, and w.

You are also expected to know the concept of **Plane Strain** and how in a plane, given ϵ_x, ϵ_y and γ_{xy}, one can obtain $\epsilon_{x'}$, $\epsilon_{y'}$, and $\gamma_{x'y'}$. The ideas of principal strains and maximum shear strains should be known. Homework # 5 is a good review of this material.

2. **Stress-Strain Relations:** You are expected to know the stress-strain relations (Hooke's law) for one-dimensional, two-dimensional and three dmensional cases.

This material is available in the material covered in Week 6. Homework # 6 (first problem) is a good review of this material.

3.**Shear Force and Bending Moment Diagrams:** Given a beam under arbitrary transverse loads, you should know how to draw the shear force and bending moment diagrams. Of special interest would be the cases with point shear forces and point bending moments, cases which give rise to discontinuities in their respective diagrams.

Homework # 6 is a good review of this material.

4. **Bending of Beams:** You should be able to calculate stresses in beams under bending moments, M_y, and M_z. Both symmetric and unsymmetric sections are included. Beer and Johnston is a good place to refresh your knowledge of bending of beams of symmetric cross-sections. The expression for the bending stress in beams with unsymmetric cross sections is given on page 280 of your text. Note that to use this equation you need to be well versed with calculating the various sectional moments of area.

You must be able to calculate the neutral axis for the case of a beam with an unsymmetric cross-section under a given set of bending moments, $M_x(z)$, and $M_y(z)$.

Given the bending moments M_x, and M_y, you should be able to calculate deflection components u and v by twice integrating the curvature terms d^2u/dz^2, and d^2v/dz^2 as given by Eqs. 9.17 on page 285 of your text. Beer and Johnston is a good place to refresh your knowledge of deflection of beams with symmetric sections.

Homeworks #7 and #8 should give you a good understanding of this material.

5. **Shear Flow:** You should be able to obtain shear flow in a thin-walled tube due to the presence of a shear force acting through the shear center. You need to know how to use Eq. 9.34, on page 296 of your text, to determine shear flow in open section thin-walled structures. Only symmetric sections will be considered in this test. You should be familiar with the concept of the shear center.

Homework #9 (solution is available on the internet) should give you a good understanding of this material.