1 Minimum outcomes

After successfully completing this course, the student should have attained, at the very least, an ability to:

2. Define Stress and Strain, and apply the general concept of 3-D stress equilibrium to 1-D and 2-D problems.
3. Define constitutive laws for linear elastic behavior and apply them in 1-D and 2-D problems in solid mechanics.
4. Solve problems of torsion, stress concentration, pressurized cylinders and contact.
5. Solve beam problems that involve normal bending stresses and shear stresses, biaxial loading and unsymmetric cross-sections.
6. Transform stresses between coordinate systems.
7. Calculate deflections in beams using the principle of superposition and energy methods.
8. Solve statically indeterminate problems.
9. Define commonly used static failure theories and utilize them for quantitative predictions.
10. Define and describe fatigue failure theories such as Stress-Life and Strain-Life, and utilize them in quantitative predictions of fatigue failure.
11. Account for fluctuating stresses and combined loads in fatigue failure calculations.
12. Apply concepts from fracture mechanics in calculating residual fatigue life in engineering components.

2 Topics and schedule

The following is a tentative list of which topics will be covered, test dates and scheduled project work. These dates are only guidelines and may change.

**Week 1: 8/23–8/25 (2 classes):** Quick review of FBDs, Shear Force and Bending Moment Diagrams in Beams, Factor of Safety

**Week 2: 8/28–9/1 (3 classes):** Differential load, shear, moment relationships. Definition of stress, Cartesian stress components, general 3-D stress equilibrium.


Week 5: 9/18–9/22 (3 classes): Contact stresses. Shear stresses in beams, two-axis bending and unsymmetric cross-sections.

Week 6: 9/25–9/29 (3 classes): Beam stresses. Stress transformations, principal stresses. Test 1 (Stresses)

Week 7: 10/2–10/6 (3 classes): Stress transformations in 3-d. Introduction of design project

Week 8: 10/9–10/13 (0 classes, Fall Break):

Week 9: 10/16–10/20 (3 classes): Ductile failure theories, maximum shear stress and maximum distortion energy.


Week 11: 10/30–11/3 (3 classes): Indeterminate structures, beam deflections.

Week 12: 11/6–11/10 (3 classes): Indeterminate beams. Design project work. Test 2 (Indeterminate structures, failure)


Week 14: 11/20–11/24 (1 class, Thanksgiving Break): Fatigue failure theories

Week 15: 11/27–12/1 (3 classes): Fatigue failure theories (cont.), combined loads. Class time for design project.

Week 16: 12/4–12/8 (3 classes): Cumulative fatigue damage (cont.), design project work. Test 3 (Fatigue)

Week 17: 12/11 (1 class): Final review, CATS.