MEC 85/CEC 30: Introduction to Solid Mechanics

Course Syllabus

Instructor: D.J. Steigmann (dsteigmann@berkeley.edu)
Office hours: M, 1-2 and F, 1-3 in 6133 Etcheverry Hall

GSI: A. Jbaily ("AJ" for short) (a.jbaily@berkeley.edu)
Office hours and location: T, 1-2 and Th, 2:30-3:30 in 136 Hesse Hall

Class meets: M,W,F at 12-1 in 105 Northgate
Discussion sections: T, 5-6 in 310 Hearst Mining Bldg.; F, 9-10 in 241 Cory Hall.

Textbooks: Engineering Mechanics, 1 and 2, by Gross et al. Springer 2009, 2011, 2013. (paperback)

Exams: Two midterms (Oct. 12 and Nov. 23 at 6:00-7:30 PM) and a final (Dec. 18 at 11:30-2:30). Closed books and notes, no electronics of any kind. Relevant formulas will be provided.

Homework: Assigned every Friday night (on bCourses) and due the *2nd following* Monday by Noon. These must be scanned and uploaded to bCourses. *Late papers will not be accepted under any circumstances.*

Grading policy: Homework (10%), Midterms (25% each), Final (40%). Course grades will be assigned using a grading curve.

Pre-requisites: Math 1A and Math 1B (Freshman Math), Math 53 and Math 54 (Sophomore Math - may be taken concurrently), Physics 7A.

Course Outcomes: Upon successful completion of the course, all students should be able to: draw free-body diagrams; apply the equations of equilibrium to two- and three-dimensional solid bodies; understand the concepts of stress, strain, and deformation; and, solve simple problems in linear elastostatics (tension, torsion, beam bending).

Topics covered (relevant chapters in parentheses):

Part 1

1. Introduction, vectors, forces (1, 2 and Appendix A)
2. Forces in two dimensions, rigid bodies, moments, force/moment equivalence, cables (2 and 3)

3. Statics, equilibrium of rigid bodies in two dimensions, free-body diagrams (3)

4. Equilibrium of rigid bodies in three dimensions, support reactions, statical determinacy and indeterminacy (3 and 5)

5. Analysis of trusses in two dimensions: method of joints and method of sections (6)

6. Beams, frames and arches (7)

7. Friction (9)

8. Work, potential energy and stability (8)

Part 2

9. Tension and compression, concept of stress, examples involving bars (1)

10. General states of stress, plane stress, principal stresses and Mohr's circle, maximum shear stress, failure criteria, stress equations of equilibrium in two and three dimensions (2)

11. Displacement and strain in two and three dimensions (3)

12. Stress-strain relation for small deformations of elastic solids. Thermal stresses, Hooke's law (3)

13. Torsion of circular bars and thin-walled tubes (5)

14. Bending of beams: Second moment of area, stress state, shear and moment diagrams, beam deflections, unsymmetric bending, combined bending and axial extension (4)

15. Buckling of beams (7)