

ENFD 375

Basic Strength of Materials

- Catalog data:** 20-ENFD-375. Basic Strength of Materials. 3 ug. cr. Stress-strain curves and properties of materials; direct stress; thermal stress; shear; torsion; flexure; deflections of beams; columns; combined stresses.
- Prerequisites:** Calculus and Analytical Geometry III (15-MATH-264)
- Textbook:** Beer, Johnston & DeWolf, *Mechanics of Materials*, 3rd Ed., McGraw-Hill
- References:** Gere & Timoshenko, *Mechanics of Materials*, 4th Ed., Brooks/Cole
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or

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- Goals:** This course introduces the basic topics of structural analysis without focusing on one specific engineering discipline. The goal is to enable the students to solve elastic problems involving any external loading, with particular focus on the calculation of stresses and deformations. This course is intended to lay the foundation for more specialized analysis classes which will focus on one specific field of engineering.

Lecture or lab topics:

1. Review of statics. Internal forces. (1 class)
2. Review of approaches to the solution of trusses (1 class)
3. The concepts of normal stress and shear stress (2 classes)
4. Stress-strain curves. Definition of normal strain (2 class)
4. Uniaxial, biaxial, triaxial states of stress. Definition of shearing stress. Hooke's Law for the general case. (2 classes)
5. Statically determinate and indeterminate structures subjected to axial forces. Temperature effects. (3 classes)
6. Effects of torque on structures. Shearing stress and angle of twist (2 classes)
7. Statically determinate and indeterminate structures subjected to torque. Interaction of gears (2 classes)
8. Transversally loaded beams. Internal shear and internal moment. Diagrams. (2 class)
9. Normal stress due to bending moment (2 classes)
10. Shear stress due to shear (2 classes)
11. Relationship between external load, shear and moment. Internal force diagrams (3 classes)
12. Design of beams for normal stress and shear stress (1 class)
13. Stress transformation. Analytical and graphical approach (Mohr's circle) (2 classes).
14. Midterms and final exam. (2 classes)

Computer usage: Due to the mostly theoretical content of the course, and to the relatively simple problems which the students learn to solve, the usage of computer programs is limited. General mathematic programs can be used to solve simple differential equations or to calculate solutions to elementary integrals or linear systems of equations. Due to the relative simplicity of the calculations involved, the use of computer programs is therefore not expressly required for a successful outcome in this course.

ABET criterion 3: a, c, e

ABET criterion 8: a, d

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