Mechanical Engineering Program
University of St. Thomas
Spring Semester 2009
Syllabus

Instructors:
Michael P. Hennessey, Ph.D.
Kaye L. Smith, Ph.D.

Contact Information:
Michael P. Hennessey, Ph.D. (Mike)
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Kaye L. Smith, Ph.D. (Kaye)
108 O'Shaughnessy Science Hall, St. Paul campus
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Schedule and Location:
Lecture (Section 02) (Kaye): TR, 6:00-8:00 PM, LL18 O'Shaughnessy Science Hall, 2/2-5/22
Lecture (Section 03) (Mike): MWF, 8:15-9:20 AM, 250 Owens Science Hall, 2/2-5/22

Office Hours for Mike: By appointment.
Mike is usually available in his office during core hours everyday (i.e. 9-5) when not in class or at lunch.

Office Hours for Kaye: MWF 1 to 2:30; other times by appointment.

Required Text:
[1] Beer, F. P., Johnston, E. R., DeWolf, J. T., and Mazurek, D., **Mechanics of Materials**, 5th edition, McGraw-Hill, 2009. ISBN: 978-0-07-352938-7.
[2] Nash, W. A., **Strength of Materials**, 4th edition, Schaum's Outline Series, McGraw-Hill, 1998. ISBN: 0-07-046617-3.

The Beer *et. al.* text will be the primary text and the Schaum's Outline book (available for free!) will be used as a supplementary study guide and a possible source for homework and exam problems. The instructors will periodically make available, either electronically through Blackboard (**Bb**) (mostly) or hardcopy, a number of handouts on lecture topics (often handwritten notes), assignments, solutions to assignments, former exams and solutions, exam solutions, complementary copies of related papers, etc.

Course Description (from St. Thomas Catalog): Principles of deformable body mechanics including stress, strain, basic loading situations, transformations of stress and strain, beam theory, and energy methods.

Prerequisite:
C- in Engineering Mechanics I (ENGR 220)

Objective: Mechanics of materials is a classic mechanical engineering course and is all about loading/deflection or stress/strain within structures. Students will learn about different loading situations applied to simple geometric structural elements such as beams and columns in addition to the transformation of the state-of-stress at a point. Specifically: (1) axial loading, (2) torsion, (3) bending, (4) beam deflection, (5) columns, and (6) Mohr's circle for plane stress. Two design/analysis projects give students an opportunity to apply principles directly to an actual structure.

Learning Outcomes (ABET 2008-9 with Homework (H), Exams (E), and Projects (P) indicated):

(e) The design/analysis projects require students to identify, formulate, and solve engineering problems (**P**).

(d) Design/analysis teams comprised of approximately 3 students are utilized and different tasks are expected for each team member (**P**).

(b) Using demonstration aids and through participation in the design/analysis projects, students are encouraged to experiment (**H, P**).

(a, k) Students use calculators to solve numerical problems (**E, P, H**).

(a) Engineering analysis ("loading/stress analysis" and "geometry/deformation analysis" specifically) is required for the design/analysis projects, homework, and the exams. Much of this analysis requires use of calculus (**H, P, E**).

(k) A modern software tool (i.e. SolidWorks™) is used for the design/analysis projects (**P**).

(g) Design/analysis reports and a presentation are required for all design/analysis projects (**P**).

(c) The "factor of safety" (FS) concept applied in stress analysis (with actual examples) demonstrates an understanding of professional and ethical responsibility (**H**).

(j) Occasionally, example problems from the real world are used to emphasize applicability (**H**).

Course Methodology: Tentative Coverage of Topics:

Lecture (largely from textbook)

1. Chapter 1: Introduction – Concept of Stress (sections 1.1-1.13)
2. Chapter 2: Stress and Strain – Axial Loading (sections 2.1-2.5, 2.8-2.12, 2.14, 2.15, 2.17, and 2.18)
3. Chapter 3: Torsion (sections 3.1-3.8)
4. Chapter 4: Pure Bending (sections 4.1-4.7)
5. Chapter 5: Analysis and Design of Beams for Bending (sections 5.1-5.4)
6. Chapter 6: Shearing Stresses in Beams and Thin-Walled Members (sections 6.1-6.4)
7. Chapter 7: Transformations of Stress and Strain (sections 7.1-7.4)
8. Chapter 9: Deflection of Beams (sections 9.1-9.3)
9. Chapter 10: Columns (sections 10.1-10.4)

Assignments: Assignments will be given on most days. A grade of 0, 1, or 2 (for more involved problems) will be assigned to each problem or sub-problem. If a reasonable attempt has been made at solving the problem, a grade of 1 or 2 points (for more involved problems) will be assigned; otherwise, a grade of 0 will be assigned. For more involved problems, partial credit is allowed (i.e. 1 point). Please submit problems in the order in which they were assigned and write your name on the top of the first page. This reduces the probability of missing a problem when grading and makes the grading easier. A 1 inch margin is required on all sides of the page, so for example, don't write where the pages are to be stapled together! Place a box or circle around the answer to the problem posed. Please staple (vs. using paper clips or "dog-tagging") assignments in the upper left-hand corner (A point will be deducted for each homework assignment that is not stapled). One last request, write large enough that I don't need a magnifying glass to grade your work.

Late Assignments: Late homework will not be accepted, except under extenuating circumstances.

Design/Analysis Projects: Two team projects will be assigned that entail design, analysis, and limited manufacturing. For the first project (*Factor of Safety Estimates for a Physical Structure*), an existing structure such as a piece of playground equipment, a simple bridge, a piece of sports equipment, or a building substructure, will be analyzed from the point of view of determining factors of safety associated with different components along with other properties such as deflection magnitudes. For the second project (*Loading Demonstrator*), a basic structure made of common and inexpensive materials will be designed that is created from simple geometrical shapes experiencing one of more of the types of loading studied in class. An effort should be made to try to make the quality of the structure as high as possible, given limited means, such as a few basic hand tools in your dorm room. Access to the Manufacturing and Project Lab (OSS LL15) is encouraged, but only under supervision (such as from John Angeli, the School of Engineering's Laboratory Manager). Knowledge of Basic Woods and Basic Metals is all that is required (from last semester's ENGR 220 course). For each project, the basic geometry of the design will be characterized using SolidWorks™. Analysis work will take the form of formulating meaningful, but yet very tractable problems and performing associated hand calculations using a calculator. Students will prepare a written report and make a presentation to the class (including demonstrating the details of their structure for the *Loading Demonstrator* project).

Grading Policy:
Homework assignments (**H**): 30%
Exam 1 (**E**): 15%
Exam 2 (**E**): 15%
Exam 3 (**E**): 15%
Note: the best 2 exam scores will be recorded and the third one will be ignored (you must take all three exams and have less than three standard deviations difference between the average of the recorded scores and the dropped score for the drop privilege to apply)
Final exam (Take home) (**E**): 10%
Design/Analysis Projects (**P**): 30% (2 x 15%)

Grading Scale (based on % correct):

100 – 90	A
89.99 – 87	B+
86.99 – 80	B
79.99 – 77	C+
76.99 – 70	C
69.99 – 60	D
<60	F

Related Courses:
Engineering Graphics (ENGR 171)
Engineering Mechanics I (ENGR 220)
Manufacturing Processes (ENGR 371)
Calculus II (MATH 114)
Multi-Variable Calculus (MATH 200)

Academic Integrity: All students are expected to understand and follow the University of St. Thomas policies on Academic Integrity. These are described at:
http://www.stthomas.edu/policies/student_policy_book/Academic_rights_and_procedures.htm

Attendance Policy: Students are expected to attend all class sessions. Contact the instructor when a special situation arises. All absences require that the instructor be informed in advance. More than 2 unexcused absences in lecture will result in a loss of 5% of your grade!

Students with Disabilities: Students with disabilities who may need accommodations are encouraged to contact the Enhancement Program - Disability Services at 651-962-6315 at their earliest convenience.

Brief Instructor Biographies:

Michael P. Hennessey joined the full-time faculty as an Assistant Professor in May of 2000. Currently he is a tenured Associate Professor of Mechanical Engineering within the School of Engineering. He is an expert in machine design, computer-aided-engineering, and in the kinematics, dynamics, and control of mechanical systems, along with related areas of applied mathematics. Presently, he has published 33 technical papers (published or accepted), in either journals (6), conferences (26), or magazines (1), with 10 of them being engineering education oriented.

Mike gained 10 years of industrial and academic research lab experience at 3M, FMC, and the University of Minnesota prior to embarking on an academic career at Rochester Institute of Technology (3 years) and Minnesota State University, Mankato (2 years).

Mike holds a Bachelor of Mathematics from the University of Minnesota (with distinction), an MS in Mechanical Engineering from MIT, and a Ph.D. in Mechanical Engineering from the University of Minnesota. He is also a member of ASME, SIAM, and ASEE.

Kaye Smith holds a B.S. in Chemical Engineering from the University of Wisconsin - Madison, and a PhD in Chemical Engineering from Stanford University. She has over 12 years of industrial experience in R&D, manufacturing and technical service working for DuPont and 3M. At DuPont she was involved with development and scale up of metal hydride hydrogen storage systems. At 3M she developed a line of nano-particle abrasives for the fiber optics market, provided technical support to the fiber optics and computer industries in abrasive applications, and did manufacturing development and scale up for liquid pavement marking materials. She has taught courses in engineering, physics and math at Century College, White Bear Lake, MN. As a 3M Thwaits fellow in the School of Engineering at the University of St. Thomas, she teaches ENGR 150, Introduction to Engineering, as well as courses in mechanics and materials. Kaye is the Project Director of the STEPS camp outreach program.