ENGR 220: Engineering Mechanics I (Statics and Dynamics)
University of St. Thomas – School of Engineering
Fall Semester 2009

INSTRUCTORS:

Lecture
Jennifer E Holte, Ph.D.
111 O'Shaughnessy Science Hall
Phone: 763-544-5258 (h)
Email: holt4902@stthomas.edu
Office Hours: 10:00 - 10:45 MWF

Lab
Michael P. Hennessey, Ph.D.
110 O'Shaughnessy Science Hall
Phone: (651) 962-5761, 952-440-5693 (h)
Email: mphennessey@stthomas.edu
Office Hours: MF 9:00-10:55 AM, R 2:55-4:55 PM; other times by appointment. Mike is usually available 9-5 everyday when not in class or at lunch.

Lab Assistant: Mr. Nick Dalbec (UST ME 2005 grad. in OSS LL13) will be available during the WR lab sections and other times TBA to support lab usage.

Schedule and Location:
Lecture (01): MWF, 10:55 – 12:00 PM Binz LL02
Lecture (02): MWF, 12:15 – 1:20 PM Binz LL02
Lab (51-54): MWRF, 1:35-2:40 PM, OSS LL10

Required Text and other Reference Material:
Beer, F. P., Johnston, E. R., Mazurek, D. F., Cornwell, P. J., and Eisenberg, E. R., **Vector Mechanics for Engineers: Statics & Dynamics**, 9th edition, McGraw-Hill, 2007. ISBN: 978-0-07-352940-0.

Hennessey, M. P., "Statics and Dynamics Projects Emphasizing Introductory Design and Manufacturing," *Proceedings of the Annual ASEE (American Society for Engineering Education) Conference*, Pittsburgh, PA, June 22-25, 2008.

The instructors will periodically make available, electronically through Blackboard (**Bb**), assignments, solutions to assignments, exam solutions, and practice exams as well as other class handouts.

Course Description (from St. Thomas Catalog): Principles of statics and dynamics including such topics as equilibrium, friction, distributed forces, work, kinetics of particles and rigid bodies, and vibrations.

Prerequisites:
Introduction to Engineering (ENGR 150)
Engineering Graphics (ENGR 171)
Calculus II (MATH 114)
Introduction to Classical Physics I (PHYS 111)

Related Courses:
Engineering Graphics (ENGR 171)
Engineering Mechanics II (ENGR 221)
Manufacturing Processes (ENGR 371)
Calculus II (MATH 114)
Multi-Variable Calculus (MATH 200)

Objective: Statics and dynamics are classic mechanical engineering sophomore topics that provide a foundation for the junior and senior level ME courses. The lecture's objective is to understand basic solid mechanics principles (such as static equilibrium and Newton's second law) that are calculus-based and apply this knowledge to analyzing many practical mechanical engineering problems. In lab, the objective is for students to become familiar with the hands-on, practical side of statics and dynamics by virtue of working on numerous projects that involve design, analysis, and manufacturing, in addition to building some basic shop skills with both wood and metal.

Grading Policy:
Homework assignments: 30%
Exams: 45%
Lab: 25%

Assignments: Assignments will be given weekly. Students are encouraged to come to the instructor's office hours with questions on the assignments.

Assignment Grading Policy: For full credit, you must submit all problems assigned. However, instructor may not grade every problem. Once your assignment or exam has been graded and returned to you, you have one week to submit a request, *in writing*, for a re-grade. Document what you feel the error or injustice was and staple your request to your original exam or homework. Submit to the instructor.

Guidelines for turning in Homework. Points may be deducted from your homework if it does not meet the following guidelines.
1) Include a brief problem statement and appropriate sketches.
2) Work must be neat and legible to receive a grade. Use a straight edge for graphical solutions, and show all calculations and sketches used to reach the solution.
3) Double underline or place a box around your answer.
4) **Staple** multiple pages together. (No paper clips or origami)
5) Include appropriate units in your answers, and denote direction and magnitude of any vector solutions.

Homework will be due *at the beginning of the lecture* on the due date. **Late homework will not be accepted without prior approval from the instructor.**

Incompletes: The grade "I" is awarded only in the case of exceptional and verifiable severe illness or tragedy. A student must have completed all but a small portion of the work for an incomplete to be considered.

Lecture attendance: Your attendance is expected. If you foresee a conflict, please contact your instructor during office hours or by email. In the event of unforeseen family emergency or illness, please contact your instructor as soon as possible. Instructors will not be responsible for distributing material or assignments missed due to unexcused absences.

Labs: Attendance will be taken on most days. If you arrive late, you will be marked as absent. More than one unexcused absence in lab will result in a loss of 5% of your lab grade! More than two unexcused absences in lab will result in a loss of 10% of your lab grade.

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

Tentative Coverage of Topics (Lecture):
Statics:
1. Chapter 1: Introduction (1.1-6)
2. Chapter 2: Statics of Particles (2.1-15)
3. Chapter 3: Rigid Bodies: Equivalent Systems of Forces (sections 3.1-20)
4. Chapter 4: Equilibrium of Rigid Bodies (sections 4.1-4,6,7,9)
5. Chapter 6: Analysis of Structures (sections 6.1-4,7)
6. Chapter 5: Distributed Forces: Centroids and Centers of Gravity (sections 5.1-6)
7. Chapter 7: Forces in Beams (sections 7.1- 6)
8. Chapter 9: Distributed Forces: Moments of Inertia (sections 9.1-7,11-15)
9. Chapter 8: Friction (sections 8.1-4,9,10)

Dynamics:
10. Chapter 11: Kinematics of Particles (sections 9.1-6,9-14)
11. Chapter 12: Kinetics of Particles: Newton's Second Law (sections 12.1-7,9)
12. Chapter 13: Kinetics of Particles: Energy and Momentum Methods (sections 13.1-6,8,10-13)
13. Chapter 14: Systems of Particles (sections 14.1 – 12)

Learning Outcomes for Lecture (ABET 2008-9 with Homework (H) and Exams (E) indicated):
(**k**) Students use calculators to solve numerical problems assigned from the textbook and on exam problems (**H, E**).
(**a, e**) Engineering analysis is required for both the homework and exams. Much of this analysis requires use of differential and integral calculus (**H, E**).
(**a**) Calculus-based physics (mechanics) is used extensively for homework and exams (**H, E**).
(**j**) Occasionally, example problems from the real world are used to emphasize applicability (**H**).

Tentative Coverage of Topics (Lab):
Basic Woods (1 week, and it's the first week of class)
Basic Metals (1 week)
3D Static Equilibrium Demonstrator (2 weeks)
2D Truss Analysis and Fabrication (2 weeks)
Mass Moment of Inertia Tester (2 weeks)
Vehicle Wheel Mass Moment of Inertia Demonstrator (2 weeks)
Pendulum Style Golf Putter (3 weeks)
Mechanical Advantage of a Hydraulic Jack (1 week)

Learning Outcomes for Lab (ABET 2008-9 with Labs (L) indicated):
(**c**) The lab projects (both static and dynamic) require innovation and creativity (**L**).
(**b**, **e**) The lab projects provide an opportunity for students to work with incomplete information (**L**).
(**c**) For the "dynamics" lab projects, students will design their own devices from scratch (**L**).
(**d**) Lab project teams comprised of approximately 2 students are utilized and different tasks are expected from each team member. An effort is made to create culturally diverse teams where possible (**L**).
(**b**) Through participation in the lab projects, students will need to experiment to get their devices working properly (**L**).
(**k**) Students will use calculators to make design and analysis calculations related to their projects (**L**).
(**a, e**) Engineering analysis is required for the lab projects. Much of this analysis requires use of differential and integral calculus (**L**).
(**a**) Calculus-based physics (mechanics) is used for the lab projects (**L**).
(**k**) A modern software tool (i.e. SolidWorks™) is used for the lab projects to characterize the geometry of the parts and assemblies designed (**L**).
(**g**) Brief lab reports and a presentation are required by all lab teams for each of their projects (**L**).

Comment Regarding Scrounging of Materials for Hands-On Projects:
As noted above, a number of the lab activities will entail designing and manufacturing some devices from common materials. I purposely encourage students to scrounge their own components and they are welcome to use some supplies in the shops (e.g. machine shop stockroom, LL15 sheet metal, and LL59 wood shop) provided that they make appropriate selections and get permission from either the Lab Manager (i.e. John Angeli) or the lab instructor. A common problem that we have had in the past is inefficient and/or inappropriate usage of some of these materials.

Students with Disabilities:
Qualified students with documented disabilities who may need classroom accommodations should make an appointment with the Enhancement Program – Disability Services office. Appointments can be made by calling 651-962-6315. You may also make an appointment in person in O'Shaughnessy Educational Center, room 119. For further information, you can locate the Enhancement Program on the web at http://www.stthomas.edu/enhancementprog/.