Course Syllabus

GE 410: Component Design
Fall 2014, MWF 1:00-1:50 pm, Transportation Building 101
Instructor: Prof. James Allison (jtalliso@illinois.edu, www.systemdesign.illinois.edu) (http://www.systemdesign.illinois.edu)
TA: Adam Cornell (cornell7@illinois.edu)

Office Hours:

- **Professor Allison:** Mondays 2:00 pm - 4:00 pm am, TB 313
- **Adam Cornell:** Tuesdays 2:00 pm - 5:00 pm, or by appointment, TB 406

Prerequisites:

It is imperative that students enrolled in GE 410 have already completed GE 311/312. If you have not, you will need to take GE 410 at a later date.

Catalog Description:

Design of basic engineering components: structural members, machine parts, and connections. Principles applied include: material failure (yield, fracture, fatigue); buckling and other instabilities; design reliability; analytical simulation.

Course Objectives:

By the end of this course you should be able to:

- Design mechanical systems based on quantitative analysis (e.g., statics, kinematics, dynamics, stress, strength, stability).
- Solve open-ended design problems, including systems that involve multiple interacting components.
- Demonstrate a solid understanding of design, analysis, and selection of basic engineering components (tension members, columns, beams, shafts, power screws, bolted joints, springs, gears, and bearings) using standard design methods and practices.

Notes on the nature of this course:

During this course you will be faced with a number of design problems that involve complicated interactions. For example, changing one element of a system design will influence many other elements of the system, often requiring additional design changes. You will learn design tools and processes that will help you deal with problems involving difficult interactions and complicated change propagation. Regardless of the domain you end up working in after graduation, whether it is mechanical design or something else, the skill of managing with complex interactions will be very valuable. The course topics, particularly the semester project, have been selected carefully to help you experience a range of complementary design problems with different types of interactions. In other words, this course is designed to help you reason through complicated design problems with challenging interactions. You will learn these skills by working through mechanical and structural design problems (and gain some mastery of these topics), but the fundamental skills and concepts extend to many other domains beyond mechanical and structural design.

Grading:

Final grades are based on how well students meet the objectives outlined above. Homework assignments, exams, and the course project will help the instructor determine how well each student meets the above course objectives.

Grade breakdown:

- Homework: 20%
- Exams: 30%
- Course Project: 40%
- Class Participation: 10%

Homework:

There are 12 homework assignments, and most are due on a Wednesday right at the beginning of class. No late homework will be accepted, but the lowest two homework scores will be dropped. While working on homework in groups is encouraged, please ensure that you know how to work through the homework problems on your own so that you can be well-prepared for the exams and have a good foundation for succeeding in the course project.

Relatively few homework problems are assigned in this course to allow time for project work and other activities. Very little if any overlap exists between the assigned homework problems. To help improve your exam performance, you may consider practicing additional homework problems beyond what is assigned. The TA may be a good resource in helping you work through any additional practice problems.

Note: This semester we will be introducing some new hands-on activities, including bolted joint design and testing, and gear set design and testing. More information about these projects will be available as the course proceeds. There is a possibility that the course schedule may be adjusted to accommodate these hands-on activities, but we hope to minimize changes (especially exam dates).

Submission: Electronic submission through Canvas is strongly preferred for homework and project deliverable submissions. You can scan and upload handwritten notes, or
submit typed documents. Electronic submission provides clear documentation of when you turned your assignment in, and it is a significant help for us in documenting student work for accreditation requirements.

Exams:

There are three in-class exams (no final exam - the semester project is the integrative assessment for the course). Course textbooks, written notes, and calculators are allowed during the exams. No electronic devices besides calculators are permitted during exams. Exams will consist of both short-answer questions designed to evaluate your conceptual understanding of the material, as well as one or more traditional quantitative problems.

If you understand the material well you should be able to answer the short-answer questions with little to no referencing of the textbook or your notes. If you have to look up the answer to each question you will run out of time! The exams are open-book/note primarily so that you do not need to memorize all of the many formulas and tables required for working problems in this class. You are expected to have a solid conceptual understanding of the material going into each exam. Do not rely on the textbook to compensate for gaps in conceptual understanding – you will not be able to complete all the exam problems if you take this approach.

Project:

The course project is a simplified automotive suspension design problem to be completed by project groups of 3-4 students. Several project deliverables are required throughout the semester that will help groups progress toward a final design. These deliverables relate to topics covered in recent lectures. These deliverables are spread out throughout the semester to help you stay on track with the project, reducing the amount of work left to be done at the end of the semester. Please plan ahead for these deliverables with your group. Most of them cannot be completed in a single afternoon/evening of work. Try to work your way through well ahead of time so that you can take advantage of office hours (or asking questions during lecture) to resolve any project deliverable questions.

Please work together as project groups on each project deliverable, and make a single submission as a group for each deliverable. Deliverables will be graded as a group. At the end of the semester each student will submit confidential peer reviews to evaluate the contribution of each group member. If a group member contributes significantly less than the rest of the group his/her project grade may be affected.

Class Participation:

Class participation will be assessed via self-evaluations, completion of in-class activities, and instructor evaluation. Active engagement in class will help ensure that you receive a good class participation score.

Re-grade Policy:

If you believe a mistake has been made in the grading of a homework assignment or exam, please prepare a written description of this mistake along with the assignment or exam and submit either to the instructor or to a TA within one week of receiving your grade. The instructor reserves the right to re-grade the entire assignment or exam when submitted for consideration of a re-grade.

A homework grading rubric is available from the TA that explains how each homework assignment was graded.

Textbooks

- **Required**: Structural Steel Design (Fifth Edition, McCormac and Csernak)
- **Recommended Reference**: Machinery's Handbook (29th edition, Oberg, Jones, Ryffel, McCauley, and Heald)
- **Recommended Reference**: AISC Manual of Steel Construction (14th edition, American Institute of Steel Construction)

Note: please be sure to purchase your own copies of the required textbooks, as you will need them for exams in addition to completing homework sets. Shigley's will be needed for the first two exams, and the Structural Steel Design text will be needed for the third exam. Required pages from the two recommended references will be provided, although if you think that you might practice machine or steel design professionally, you should consider purchasing your own copies of these references.

A 10th edition of Shigley's is now available. We are still using the 9th edition. You may use the 10th edition, but please be sure to obtain the correct homework problems.

Adjustments

The instructor may make adjustments to the course schedule or other elements of the syllabus. Any adjustments will be announced in class or via email/Canvas announcement.
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