CGN4910 STRUCTURES COMPREHENSIVE SYSTEM DESIGN SPRING 2004

"Structural Engineering Capstone Design"

INSTRUCTOR: Thomas Sputo, Ph.D., P.E.
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DESCRIPTION: Simulation of a design office experience through the completion and presentation of a comprehensive building design. Students will work in groups to complete a total structural building system design.

TEXTS: Required: *LRFD Manual of Steel Construction*, 3nd ed, AISC
ACI 318-02, *Building Code Requirements for Structural Concrete,* ACI
Class notes and references (Available through ASCE)
Class CD (Contains additional reference materials)

TIME: Tu, Th 6th and 7th Period (Weil 234)
Occasionally other times and places for special topics and field trips

PREREQUISITES: Working knowledge of basic steel and concrete design
Working knowledge of basic structural analysis
Working computer knowledge:
(MS Word or Word Perfect; Excel, Frame analysis software) - required
(AutoCad; MathCad) - helpful

COURSE OBJECTIVES:

1. Develop skills in structural steel design and analysis beyond those taught in the basic steel design course.

2. Through the use of student design teams, develop the comprehensive design of a steel-framed building, including connections. Present the results of that design in a professional manner, both written and orally.

3. Introduce students to various topics related to structural engineering consulting practice, including business related topics.

TOPICS TO BE COVERED: (Subject to Change - addition or deletion or change of order)
Material to be presented in two parallel tracks ... Technical (6th) and Business (7th) ... to the extent practical

Technical

1. Building Loads
    a. Gravity
    b. Wind
2. Floor System Design
    a. Non-composite beam
    b. Composite beam
    c. Open web steel joist / joist girder
    d. Steel floor deck
    e. Serviceability (deflection, vibration, camber)
3. Roof System Design
    a. Non-composite beam
    b. Open web steel joist / joist girder
    c. Steel roof deck
    d. Serviceability (deflection, ponding)
4. Frame Analysis and Design
    a. Theory, analysis, and design of beam-columns
        i. Effective length factors
    b. Frame analysis
        i. 1st order and 2nd order
    c. Serviceability (building drift)
5. Connections
    a. Basics of bolts and welds
        i. Concentric and eccentric loading
        ii. Prying action
    b. Shear connections
        i. Single plate (shear tab)
    c. Moment connections
        i. Flange plate
        ii. Column web / flange strengthening
    d. Column base plates
6. Foundation design

Business and Professional

1. Structural engineering consulting firm organization
2. Building design process
3. Marketing of structural engineering services
4. Design contract basics
5. Risk management for engineers / professional liability insurance
6. Financial management for structural engineering consulting firms
7. Building codes
8. Legal requirements
9. Registration law

COURSE "RULES"

1. **Please be nice.** As a class, you will only get out of this what you collectively put in. You have the opportunity to learn about engineering practice from a practicing engineer. Take advantage of this opportunity!

2. Attendance at lecture is *"mandatory."* **The instructor retains the right to reduce final letter grades for excessive absences or lack of participation, regardless of total points earned.**

3. Be on-time to class. The instructor will start class on-time. The instructor will endeavor to end class on-time, however, class is over when the instructor says it is over. Do not start closing books, etc., as a way of informing the instructor that you feel that class is over. The instructor takes **great offense** to this.

4. **Each lesson requires preparation by the student prior to the lecture. Study / read the assigned material prior to the lecture.**

5. The textbooks and notes are required for all lectures.

6. Homework will be neatly written on engineering paper, or printed on clean white paper (if using MathCad, Excel, etc.) Number, staple and label all pages. **No re-used paper! No exceptions.**

7. No make-up work will be allowed, except in cases of emergencies or civic responsibilities (jury duty, etc.), provided that the instructor is notified by e-mail in advance. Provisions for make-up work will be determined on a case-by-case basis.

8. Some class communication will be by means of e-mail. Check your e-mail regularly (at least daily). Keep the instructor informed of any changes to your e-mail address. Failure on the part of the student to keep-up with e-mail communications is not excusable.

GRADING: GRADING SCALE: (May be relaxed at the option of the instructor)

93 - 100	A
90 - 92.99	B+
85 - 89.99	B
83 - 84.99	C+
77 - 82.99	C
75 - 76.99	D+
70 - 74.99	D
00 - 69.99	E

Homework and Assignments	30%	
Final Project	70 %	(Includes presentation and written submittal) - **GET STARTED EARLY !**

IMPORTANT UNIVERSITY INFORMATION

Academic Honesty:

All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a student at the University of Florida and to be honest in all work submitted and exams taken in this class and all others.

Accommodations for Students with Disabilities:

Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the instructor when requesting accommodation.

This short paper by Professor Yao from Texas Tech is a pretty good summery of my thoughts and philosophy on grades. I could not have said it better than this.

Sputo

ON GRADES AND GRADING

by James T. P. Yao for his students and interested colleagues

The grade in a given course is a measure of the student's performance in that endeavor. The overall grade point averages are indeed important considerations for all students. When I was a student at the University of Illinois in Urbana-Champaign, I did care about my grades at that time. However, I never complained about any of my grades though, at times, I felt that the grade I received in a particular course might not be fair. The fact is, on the average, the overall grade point average did reflect the knowledge gained and the effort that I put into my college education. There were courses for which I thought that I deserved a better grade than the one on my record. On the other hand, I also had grades that were better than what I expected and/or deserved. In the long run, they all averaged out at the end of my college career. Most importantly, I learned from each professor and from each course that I had.

A few years after I graduated, I forgot all my grades. No one has ever asked for my grades just a few years after I graduated from college. To date, however, I have kept all the basic knowledge that I gained from my college education. Especially, the method of learning new things on my own has been useful. If the students aim at learning as much as they can from each course and each professor, the good grades will come as a result of their diligent work, on the average. On the other hand, if the students waste their time arguing about their grades, they will lose time for studying new lessons and thus hurt their future grades.

As a teacher, I try very hard to be fair and consistent in grading student papers. The student will get a perfect score if he/she gives a correct answer. If the answer is not correct, the teacher is the one who judges how serious the error is and assigns a partial score accordingly. As a student, I had several professors who did not give partial scores. The reason was that, the engineering system could fail with the wrong answer, no matter how close the answer is to the correct one (e.g., exactly the same number but with a wrong sign). I do not agree with that policy but respect their judgement in those courses. In any event, partial scores are subjective depending on the experience and viewpoints of the individual teachers. It is counter-productive to argue about it.

Please be careful in doing your homework, tests, and other assignments. People's lives and properties will depend on your work someday in the near future. Try to learn as much as you can while you are in school. Communicate with your teachers and classmates frequently, and concentrate on the learning process. With knowledge, you will become a successful and proud engineer soon. **HAVE KNOWLEDGE, WILL SUCCEED!**

OCCAM'S RAZOR

by John H. Lienhard
The University of Houston

There is a wonderful old Shaker tune,

> 'Tis a gift to be simple, 'tis a gift to be free;
> 'Tis a gift to come down where you ought to be

Those lines should make up the first chapter in any book on engineering design. But how do we find the natural threads of simplicity that run through the world around us?

Simplicity in design was a lesson I fell into when the Army drafted me -- after I'd finished college. They assigned me to the Signal Corps Engineering Labs and put me to work designing research equipment. There I met a fine designer, Jules Soled, a person who could clearly teach me things. So I said to him, "Teach me, and I'll work for you." He taught me many things I hadn't learned in school, and his central lesson was always this:

> Do a first design. Then attack it. Your first design will be elegant and complicated, but it'll always work better when you get rid of complication. In a really good design you eventually make the very design itself unnecessary. And that is very hard to do because we like complication.

That idea is really quite old. The towering 14th-century philosopher William of Occam put it this way: "Multiplicity ought not to be posited without necessity." William was telling us **we should make no more assumptions than we really need to explain anything -- the simplest explanation is best.** We call that idea Occam's Razor because it helps slice away the junk in our thinking.

Look at the safety razor. For years designers fought with the problem of loading, mounting, and unloading a blade in a holder. If you're old enough, you'll remember Schick's "push-pull, click-click" advertisement for its mechanism. Keeping the action workable, and the blade solidly in place, was a big problem. Then some bright person applied Occam's razor to the razor-mounting problem. That designer realized you could simply mold the blade right into the plastic packaging. Now who buys replaceable razor blades? Instead, the blades are set, very solidly and with great precision, right into a cheap throwaway piece of plastic. We've designed blade-holding mechanisms out of existence. That's what Soled meant when he said that good design makes the design itself unnecessary.

But to take that last step -- to walk the plank from a clever design to no design at all -- takes nerve as well as imagination. **We're so tempted to look smart by mastering complication instead of simplicity.** If we go back to our Shaker tune,

> 'Tis a gift to be simple, 'tis a gift to be free;

the second line says:

> 'Tis a gift to come down where you ought to be

Good design exacts a price from our egos, but it really is a gift -- it really is freedom -- to find the simplicity in things and finally to reduce an engineering design down to where it ought to be.