CE 40280: Structural Steel Design
Spring 2011
University of Notre Dame
Department of Civil Engineering & Geological Sciences

Course Description: Design of structural steel members/systems using basic fundamentals of mechanics, principles of steel behavior at element and system level. Course integrates current codes/standards and commercial software into semester-long project, providing for direct application of concepts to design.

Interface to Practice: The class will include the design of an actual steel building using LRFD/ASD Method: University of Chicago Hospital Annex (provided by Thornton-Tomasetti), utilizing code-specified design procedures and commercial software. Student teams will utilize *mobile design offices* equipped with IBC, Chicago Building Code and ASCE 7 to prescribe loads, software packages such as SAP 2000 and ETABS to conduct structural analysis and AutoCAD for rendering. Course will also include site visits, if arrangements can be accommodated, and we will officially sponsor some of the Challenges and Innovation in Civil and Environmental Engineering Lectures, with follow up assignments for extra credit.

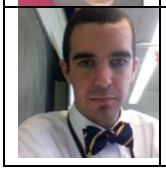
Course Objectives: By the end of the semester, students will be able to:

1. Understand the behavior, supporting theory and codification of the following member classes:
    a. Tension Members
    b. Compression Members
    c. Flexural Members
    d. Members under Combined Action (Flexure + Axial)
    e. Welded and Bolted Connections
2. Apply AISC Steel Construction Manual to analyze and design members from the above classes
3. Execute an integrated design project, in a team setting, to demonstrate the following competencies:
    a. Specification of dead, live and environmental loadings using governing codes and standards
    b. Development of finite element model in commercial software
    c. Analysis of model to determine governing moments, axial and shear forces using code-mandated load cases
    d. Design of typical members in each of the aforementioned member classes (excluding

connections) in accordance with AISC Steel Construction Manual

e. Preparation of final report (Written and Oral) to the client

Course Leadership:

	Dr. Tracy Kijewski-Correa (Dr. KC)	tkijewsk@nd.edu	Instructor
	Dustin Mix	dmix@nd.edu	TA for homework questions, part-time grading
	Sarah Bobby	sbobby@nd.edu	Primary grading
	Patrick (Pat) Murren	pmurren@gmail.com	Project TA

Lectures:
T, Th 11:00 am -12:15 pm
127 Niewland Science Hall

Design Meetings:
W 12:50 pm - 1:40 pm
155 DeBartolo Hall

Office Hours:
Wednesdays, 3:00-5:00 pm or by appointment
156B Fitzpatrick Hall
Dr. KC (631-2980)

Homework Help:
Wednesdays, 7:00-9:00 pm
107 Cushing Hall
Dustin Mix (631-3914)

Course website:
sakai.nd.edu
All course lectures, homework, solutions and project documents will be archived at this site in advance of their assignment/delivery. Hardcopies will not be provided.

Teaching Model:
1. Introduction of concept or behavior (physical)
2. Introduction of code representation
3. Application of code by in-class interactive examples employing LRFD and ASD

4. Reinforcement of code application to specific member types through homework and exams
5. Application to actual comprehensive applied design through course project

Texts: *Steel Design* by William T. Segui, 4th Edition, Thomson, 2007, ISBN-13: 978-0-495-24471-4, ISBN-10: 0-495-24471-6

Steel Construction Manual, Thirteenth Edition, AISC

Grades:

2 Examinations	40% (20% each)
Design Project	20%
Homework	15%
Final Exam	25%
	100%

Assignments:

- Homework will be collected at the beginning of the class on the assigned due date. Any homework received after this date will have a 10% reduction in score for each day late.
- Use only 8 ½" x 11" paper
- Use only one side of the paper. Staple multiple sheets in the upper left corner.
- Show all work with answer boxed. The right answer with no work shown will receive zero credit.

Examinations: There will be two midterm examinations and one final examination in this course. Students will be allowed to use their Steel Construction Manuals and calculators for all exams. Individuals with unexcused absences for these exams will be given a zero grade.

Attendance: Lecture attendance is not required, though regular attendance is highly correlated with student success in this class.

Honor Code: All students are expected to comply with the Honor Code Pledge: "As a member of the Notre Dame community, I will not participate in or tolerate academic dishonesty." University policies can be reviewed in the Student Guide to the Academic Code of Honor (www.nd.edu/~hnrcode). Specific interpretations of this Code, relative to this course include:

- Students are allowed to work with their peers on homework assignments, but each student is expected to submit their own work for the assignment.

- All members of the project team are expected to equally contribute to the project deliverables. Discussion of the project amongst teams is permissible; however, each team is to conduct and submit their own unique design; peer evaluation of each teammate's contribution to the project will be considered in project grading.
- Students may not receive assistance, of any kind, from their peers on examinations.

Final Examination: Monday, May 9, 2011 from 10:30 am - 12:30 pm, location TBA

Credits: 4.0 Credit Hours (3 Credits Lecture, 1 Credit Design Lab)

Target Audience: Required for senior undergraduate students specializing in Structural Engineering

Pre/Co-Requisites: Civil Engineering Materials, Introduction to Structural Engineering, Structural Analysis, Solid Mechanics, Statics

ABET Outcomes: This course satisfies the following ABET Outcomes:

- Student Outcome #1: Graduates will possess an ability to apply knowledge of mathematics, science, and engineering.
- Student Outcome #3: Graduates will possess an ability to identify, formulate, and solve engineering problems in both individual and team environments, particularly in the design of a system, component, or process to meet desired needs.
- Student Outcome #5: Graduates will be able to communicate effectively, both orally and in writing, and both individually and as members of multi-disciplinary teams.
- Student Outcome #7: Graduates will recognize the need for and an ability to engage in life-long learning and the importance of professional licensure.
- Student Outcome #8: Graduates will possess an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- Student Outcome #9: Graduates will possess an understanding of professional practice issues including considerations in public policy or project management.

Specific outcomes will be assessed in this course by having some of assignments tracked as part of the mandatory ABET evaluation. Anonymous student work and anonymous distribution of grades on

these selected assignments will be provided as examples to site evaluators for:

- Student Outcome #3: Performance Criteria 2: Work in a team environment to analyze course projects involving identification, formulation, and solution of problems.
- Student Outcome #5: Performance Criteria 2: Evaluate written or oral reports presented by other students or engineering professionals.
- Student Outcome #5: Performance Criteria 3: Work in a team environment to present both oral and written reports on an engineering design or an engineering lab.
- Student Outcome #5: Performance Criteria 4: Use contemporary presentation tools to present an oral report synthesizing an engineering design.
- Student Outcome #5: Performance Criteria 5: Share responsibilities in a team environment.
- Student Outcome #5: Performance Criteria 6: Develop, identify problems and propose an agreed upon solution in a team environment.
- Student Outcome #7: Performance Criteria 3: Understand the impact of engineering failures.
- Student Outcome #8: Performance Criteria 1: Integrate engineering tools and techniques in identifying potential solutions to problems presented in civil engineering.
- Student Outcome #8: Performance Criteria 2: Use commercial or develop personal software for addressing questions in engineering design and problem analysis.
- Student Outcome #8: Performance Criteria 3: Identify constraints, options, and viable solutions for engineering problems in structural or environmental engineering
- Student Outcome #9: Performance Criteria 1: Assess case histories of engineering projects (both successful projects and failures) with emphasis on the role of professional practice in project outcomes

TENTATIVE SCHEDULE OF LECTURE PERIODS
(75 minutes each)

Module	Lecture	Date	Topic	Book Chapter
I	1	1/18	Course Overview, Intro to Steel	Ch. 1
I	2	1/20	Load Specifications, Design Concepts I	Ch. 1-2
I	3	1/25	Load Specifications, Design Concepts II	Ch.2
II	4	1/27	Tension Members I	Ch. 3
II	5	1/26	Tension Members II	Ch. 3
II	6	2/1	Tension Members III	Ch. 3
III	7	2/3	Compression Members I	Ch. 4
		2/3	Challenges and Innovation Lecture: Gurley (3:30 pm, 129 DeB)	
III	8	2/8	Compression Members II	Ch. 4
III	9	2/10	Compression Members III	Ch. 4
III	10	2/15	Compression Members IV	Ch. 4
	E1	2/17	EXAM 1	Ch. 1-4
IV	11	2/22	Flexural Members (Beams) I	Ch. 5
IV	12	2/24	Flexural Members (Beams) II	Ch. 5
IV	13	3/1	Flexural Members (Beams) III	Ch. 5
IV	14	3/3	Flexural Members (Beams) IV	Ch. 5
IV	15	3/8	Flexural Members (Beams) V	Ch. 5
IV	16	3/10	Axial & Bending (Beam-Columns) I	Ch. 6
	--	3/15	SPRING BREAK	
	--	3/17	SPRING BREAK	
IV	17	3/22	Axial & Bending (Beam-Columns) II	Ch. 6
IV	18	3/24	Axial & Bending (Beam-Columns) III	Ch. 6
IV	19	3/29	Axial & Bending (Beam-Columns) IV	Ch. 6
	E2	3/31	EXAM 2	Ch. 4-6
		3/31	Challenges and Innovation Lecture: Rahimian (3:30 pm, 129 DeB)	
VI	20	4/5	Bolted Connections I	Ch. 7
VI	21	4/7	Bolted Connections II	Ch. 7
		4/7	Challenges and Innovation Lecture: Eckmann (3:30 pm, 129 DeB)	
VI	22	4/12	Welded Connections I	Ch. 7
VI	23	4/14	Welded Connections II	Ch. 7
VI	24	4/19	Building Connections	Ch. 8
VI	25	4/21	Composite Decks	Ch. 9
--	--	4/26	FLEX SLOT	--
--	--	4/28	FLEX SLOT	--
I-VI	26	5/3	Course Review	
	E3	5/9	FINAL EXAM: 10:30 am -12:30 pm	Cumulative, Emphasis Ch. 7-9

TENTATIVE SCHEDULE OF DESIGN MEETINGS
(50 minutes each)

Class #	Date	Topic	Deliverable
1	1/19	Group formation, Hancock Case Study	
2	1/26	Distribution of Laptops and Plans, Introduction to Project	
3	2/2	Load Specification I	
4	2/9	Load Specification II	
5	2/16	Load Specification III	
6	2/23	Model Development I	Load Analysis Component
7	3/2	Model Development II	
8	3/9	Analysis Execution: Results Extraction	
--	3/16	SPRING BREAK	
9	3/23	Beam Design I	Model & Deflection Analysis Component
10	3/30	Beam Design II	--
11	4/6	Column Design I	Beam Design Component
12	4/13	Column Design II	--
13	4/20	Final Report Guidelines	Column Design Component
14	4/27	FLEX SLOT: Contemporary Issues	
15	**5/4**	**Last Class Day: Group Presentations**	**Final Design Report Due**

SUMMARY OF COURSE GOALS AND EXPECTATIONS

Course Goals:

1. An introduction to the comprehensive design process
2. An understanding of the behavior of steel members
3. Training in the usage of Steel Construction Manual in the design of steel members

Expectations of Students:

- Honor the intermediate project deliverable deadlines
- Approach the project as equal members of a design team
- Bring your questions to your instructor and TAs early and often
- Attend lectures and participate
- Stay current on readings and homework
- Familiarize yourself with the Steel Construction Manual