CE 432/532 - ADVANCED STRUCTURAL DESIGN IN STEEL

Advanced Structural Design in Steel (3) I Advanced problems in the analysis and design of steel structures including beam-columns, plate girders, composite construction, multi-story buildings; static and dynamic vertical and lateral loads; connections; computer applications. May be convened with 532.

PREREQUISITE: CE 334

INSTRUCTOR: Dr. A. Haldar

OFFICE: Civil Engineering, 220E

PHONE: 621-2142

E-MAIL: haldar@u.arizona.edu

TEXT: (1) Steel Construction Manual, AISC, 14th Ed. If you do not have the manual, please talk to me after class to buy it at a discounted price. (required)

(2) Class handouts (I will email to you) (required)

(3) Steel Structures Design and Behavior by Salmon and Johnson, 4th Ed. (not required)

MEETING TIME: 3:30 - 4:45, TTH

MEETING PLACE: HARV 313

GRADING:

- 2 One-Hour Exams 40%
- 1 Final Exam 30%
- Home Work 10%
- Project 20%

100%

FINAL EXAM: December 7, 2012 (Friday), 3:30 to 5:30 PM

OFFICE HOURS: Open office hours
COURSE OUTLINE

Part 1 - Design of a multi-story building

- Conceptual design
- Load analysis
- Design of all structural elements
- Detail of all connections
- Estimate of weight of steel
- Discussion
- A detailed project report

Exam #1

Part 2 - Beam-Column design

- Braced frames
- Unbraced frames

Exam #2

Part 3 - Design of plate girders

Modes of failure
- Elastic buckling
- Bending in the plane of web
- Local buckling
- Buckling in the plane of web
- Vertical buckling of the compression flange
- Shear buckling
- Inelastic buckling under pure shear
- Tension field action
- Design of stiffeners
  - Bearing stiffeners
  - Intermediate stiffeners

- Preliminary design of a plate girder
- A detailed design project

Part 4 - Composite steel-concrete construction
A. DESCRIPTION OF BUILDING

An office building needs to be constructed in Tucson, Arizona. The approximate plan area is 90’ x 120’. Assume that local zoning law does not permit construction of buildings more than seven stories high.

B. STRUCTURE TYPE

The building should have a flat reinforced concrete roof slab. The supporting vertical structure should be steel frame with bracing. Partition walls may be the non-load bearing types.

C. DESIGN CRITERIA

Consider dead load, live load, wind load, snow load, and any other pertinent load. Use the Tucson Building Code or any other code (should be referenced).

D. REQUIRED WORK

1. Architectural floor plan
2. Architectural elevations and sections
3. Vertical frame and bracing systems
4. Structural floor plan

E. NOTEBOOK

1. Load analysis
2. Analysis of a typical vertical frame
3. Design of all structural elements
4. Detail of all connections (use bolts or welds)
5. Estimate the weight of steel required for the building (approximate)
6. Discussion

F. PROJECT DUE – December 5, 2012 (Wednesday) (last day of class for CE 432/532)

You may work in groups of two.
### ABET 2010 Criteria Course Classification Form

Course Number  **CE 432**  
Course Name  **Advanced Structural Design in Steel**  
Required? Circle: **YES / NO**  
Semester/Instructor  **Fall 2009/Haldar**  
Homework Frequency?  _weekly_  
Exam Frequency?  Two (2) midterms & one (1) final  
Course Project?  Circle: **YES / NO**  
Labs or Case Studies?  Circle: **YES / NO**

For each of the following ABET outcome criteria, please list the level (High, Medium, Low, or blank if not applicable) contained in this course. The criteria descriptions that will be used by the College in the ABET evaluation are attached. Please describe the relevant course activities that you can use to justify why you think your course meets the criteria. **No course is expected to address all of these criteria and it would be rare to have more than 2 or 3 criteria at a high level (except a capstone course)** Be conservative in your judgment. For the ABET evaluation, we will assess student performance for criteria that are judged High. If you judge your course as High in a criteria, then the course should include a large percentage of effort (class time, homework, projects) devoted to the criteria. Note that 2 extra table entries are available for departments to specify their own criteria.

<table>
<thead>
<tr>
<th>Outcome criteria</th>
<th>Level</th>
<th>Relevant Activities</th>
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<tbody>
<tr>
<td>A. Apply mathematics, science and engineering principles</td>
<td>M</td>
<td>Advanced analysis of structures and application of principles of math/mechanics</td>
</tr>
<tr>
<td>B. Ability to design and conduct experiments and interpret data</td>
<td></td>
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<tr>
<td>C. Ability to design a system, component, or process to meet desired needs</td>
<td>H</td>
<td>Design of a multi-story building and a plate girder</td>
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<td>D. Ability to function on multidisciplinary teams</td>
<td>M</td>
<td>Work in a group to complete the building design project</td>
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<td>E. Ability to identify, formulate, and solve engineering problems</td>
<td>H</td>
<td>Develop the building project from the conceptual stage to final product</td>
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<tr>
<td>F. Understanding of professional and ethical responsibility</td>
<td>L</td>
<td>Ethics in complicated engineering designs</td>
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<td>G. Ability to communicate effectively</td>
<td>M</td>
<td>Develop a detailed engineering report</td>
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<tr>
<td>H. The broad education necessary to understand the impact of engineering solutions in a global context</td>
<td>L</td>
<td>Discussion of design of complicated structural systems around the world</td>
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<tr>
<td>I. Recognition of the need for and an ability to engage in life-long learning</td>
<td>L</td>
<td>Since design codes change frequently, how to stay up to date on design guidelines</td>
</tr>
<tr>
<td>J. Knowledge of contemporary issues</td>
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<tr>
<td>K. Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice</td>
<td>M</td>
<td>Analysis of different types of structures and use of modern software for the analysis of structures.</td>
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<tr>
<td>L. Pass the FE exam as the first step towards professional registration</td>
<td>L</td>
<td>The course contents relate directly to the design of steel structures that is covered in the afternoon section of the FE exam</td>
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<tr>
<td>M. Be proficient in the major areas of civil engineering</td>
<td>M</td>
<td>Analysis and design of complicated steel structural systems – multi-story buildings, bridges</td>
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