Northeastern University

Department of Civil and Environmental Engineering

CIVU 425
Steel Design

Catalog Description: Design of steel members subject to tension, compression, bending, and combinations of loading. Design of connections, braced frames, and rigid frames. Design is based on the latest Load Resistance Factor Design Specifications of the American Institute for Steel Construction Manual.

Pre and Co-requisites: CIVU 320 taken concurrently

Expected computer skills: Basic knowledge of MS Windows environment (Word, Excel).

Text and Other Materials: William T**.** Segui, *LRFD Steel Design*, 3rd Ed., 2003. Recommended: AISC Steel Construction Manual (13th edition, 2005), to be purchased through the instructor.

Instructor: Luca Caracoglia (Room SN 441, 617-373-5186, lucac@coe.neu.edu)

Assistant: Antonio Velázquez-Hernández (Room SN 436, antoniov@coe.neu.edu)

Course Schedule: Mon, Wed 2:50pm to 4:30pm (151 Forsyth, Bldg. #55)

Office hours: Mon, 4:30pm-6pm Wed 9:15-11:30am

Course Web Site: Information available on Blackboard (http://blackboard.neu.edu/), including announcements, assignments and reference materials.

TOPICS

1. Design for tension members
2. Design for compression members
3. Design for members in bending
4. Design for members with combinations of loadings (e.g., beam-column members)
5. Design of simple connections
6. Design of braced frames and rigid frames (introduction). Base plates

COURSE OBJECTIVES

1. To equip students to design the steel members, connections, and frames found in the topic list using the AISC Manual with emphasis on Load and Resistance Factored Design.
2. To enable students to determine design loads specified by building codes for various structural types.
3. To impress students that analysis and design are an integrated process.

EXAMS AND ASSIGNMENTS

Assignments will consist of design problems, typically assigned once a week and due the following one. Problems will involve sketches, calculations, etc.; organization is important. Mid-Term Exam, Final Exam.

POLICIES ON NEATNESS AND ACADEMIC HONESTY

University policies on neatness and academic honesty will be adhered to.

GRADING FORMULA

Assignments (30%), Mid-Term Exam (30%), Final Exam (40%)

ADDITIONAL INFORMATION FOR STUDENTS

Evaluation: There will be eight to ten homework assignments, one midterm and one final exam. The grades for the class will be determined from the total points as follows: assignments (30%), Mid-Term Exam (30%), Final Exam (40%).

Expected Test Dates: One midterm and one final exam**,** TBD.

Midterm and final examination policy: All examinations are open book and notes. All devices with communication capabilities, including cellular phones, pagers, I-PODs, must be turned off during the examination. Stand-alone calculators may be used during the examination (please, do not use your cellular phone calculator). Laptops or palmtops are not permitted.

Student Responsibilities: Class attendance is responsibility of each individual. If a student should elect not to attend a class, he/she is responsible for any handouts, announcements, reading material and content of missed lecture. Class conduct: please be aware that other students are present, especially if you need to leave early or happen to arrive late; asking questions is welcomed; careful preparation of the homework is expected.

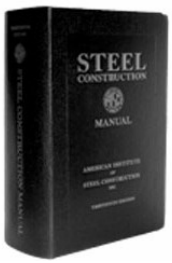
Scholastic dishonesty (e.g., cheating, plagiarism, collusion, record falsification, etc.) will be punished according to NU policies and standards**.**

Guidelines for submitting your homework: Homework assignments are due in class on the specified date. Turn in what is completed by the deadline for full credits. Late submission is accepted (up to one week) after the specified deadline BUT partial credit will be considered: 10% reduction per extra day; no homework will be graded if submitted one week after the due date and will be returned with zero points. All submissions must be your own work. Group-study is acceptable; however, identical, or semi-identical assignments will not be tolerated.

Homework can be turned in either using the mailboxes located in front of SN 441 (instructor's office) or the mailbox in SN 400. Please, write your name, date of submission and the class name (CIVU425) on the first page of the documents and indicate the total number of pages that are being submitted (please, write clearly). In general you will be graded on the correctness of your answer; however, the clarity through which you express it is important. Please try to be neat, since it will help us during the process and will contribute to an easier and fair instructor's evaluation.

Instructor Responsibilities: Provide adequate information and explanation on each topic covered by the program in the class. Be concise but thorough in the explanations. Prepare additional material for supporting the students during the learning process (e.g., handouts, examples, to be posted on Blackboard). Encourage discussion. Fair grading.

AISC Manual of Steel Construction. This Manual is the thirteenth major update of the AISC (American Institute of Steel Construction) Steel Construction Manual, which was first published in 1927. With this revision, the previously separate Allowable Stress Design and Load and Resistance Factor Design methods have been combined. Thus, this Manual replaces both the 9th Edition ASD Manual and the 3rd Edition LRFD Manual (discussed in the Textbook).



The following specifications, codes and standards are printed in Part 16 of this Manual:

A. 2005 AISC Specification for Structural Steel Buildings
B. 2004 RCSC Specification for Structural Joints Using ASTM A325 or A490 Bolts
C. 2005 AISC Code of Standard Practice for Steel Buildings and Bridges

(courtesy: American Institute of Steel Construction, http://www.aisc.org)

The following resources are also included on the CD included with this Manual

A. AISC Design Examples, which illustrates the application of tables and specification provisions that are included in this Manual.
B. AISC Shapes Database V13.0 and V13.0H
C. Background and supporting literature for the AISC Steel Construction Manual

Please note that three to four copies of the AISC Manual are available to the students and can be temporarily borrowed from the CEE Department. Please ask Ms. Pat Michaud, Administrative Manager of the CEE Department (SN 400).

Purchasing the AISC Manual. The manual is not required but can be purchased by the students through the instructor at a discounted price. The Manual is available to students for the price of $120 (Retail price is $175/AISC member or $350/non-member). Students are kindly requested to express their choice upon completion of the roster that will be distributed in class. Names will be collected by the instructor.

A specific credit card purchase form will be handed out (payments by credit card are preferable but checks are allowed). Students are kindly requested to return the appropriately filled credit-card payment form on the second day of classes. A copy of the form will also be available on Blackboard (http://blackboard.neu.edu/). Please keep in mind that at least two to three weeks are necessary for processing the order and for the books to be received by NEU. The books can be picked up from SN 400; a specific announcement will be made.

COURSE SCHEDULE AND ORGANIZATION

- 15 weeks of classes
- Thanksgiving week November 22 to November 27
- Final class: December 6

COURSE PROGRAM, EXTENDED

(1) Introduction to steel, Design concepts in steel (1.0 week)

Material properties
Stress-strain curves of the material
Building codes
Introduction to probability-based approach for design
AISC/Load and Resistance Factored Design

(2) Tension members (uni-axial normal force, strength failure) (2.0 weeks)

Design procedures
Gross vs. Net Area
Staggered fasteners
Examples

(3) Compression members (uni-axial normal force in compression) (3.5 weeks)

Columns
Simple Stability: Buckling Theory (Euler), Ideal behavior
Simple Stability: Real columns (imperfections), elastic, inelastic
Local stability of steel shapes
Torsional and lateral-torsional stability of non symmetric profiles
Introduction to braced vs. non-braced frames

Mid-Term Exam (Topics 1 to 3)

(4) Beams (elements carrying transverse loads) (3.5 weeks)

Bending (M, uni-axial)
- Laterally supported vs. non supported beams
- Ultimate capacity for Laterally Supported beams
- Introduction to Plastic Analysis and Design
- Local stability (compact shapes)
- Design examples

Shear (strength, design),
Deflection limit states, serviceability

General design steps (summary)

Examples of bi-axial bending

(5) Beam-columns (elements carrying both M and P) (2.5 weeks)
- Loading combination (axial, bending)
- Frames (intro; braced vs. un-braced, continued from Section 3)
- Local stability issues (e.g., web)
- Design Formulae, introduction, understanding
- Simple trusses, examples

(6) Simple connections (1.5 weeks)
- Classification of bolts
- Failure modes (shear, tension and shear)
- Examples

(7) Design of Rigid and Flexible Frames (1.0 weeks)
- Classification of frames (examples)
- Beam-column connections
- Lateral-sway inhibited vs. sway un-inhibited beam-columns
- Examples

Final Exam (Topics 1 to 7)