CE6143 STEEL STRUCTURES

New York University Tandon School of Engineering
Department of Civil & Urban Engineering
Course Outline CE6143 Steel Structures
Fall 2017

Adjunct Industry Professor J. Jong Lou, Ph.D., P.E.
Thursdays 6:00-8:30 PM; RH 207

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Course Pre-requisites

Students must have completed CE2123 (Mechanics of Materials), CE3133 (Structural Analysis), and CE3143 (Steel Design). This course builds on these introductory courses. Basic engineering design knowledge and experiences are considered essential - though not mandatory. Basic proficiency in computer software such as: STAAD, RISA3D, RAM Steel, ETABS, MathCAD, MATLAB, AutoCAD, Microsoft Word (Engineering) & Excel is required.

Course Description

The course is critical for the design and analysis of Steel Structures. It integrates the theory & practice for the analysis & design of Steel Structures.

Course Objectives

Students are expected to:
- Understand the materials: steel grades, and shapes, etc.
- Understand the design philosophy: ASD (Allowable Stress Design), LRFD (Load and Resistance Factor Design), other optional specs (Allowable Strength Design – also called ASD by the latest edition of AISC), Pros and Cons of each design methodology
- Flexural Analysis: Major role of Steel Plate Stability, Local Buckling, Beams braced against Lateral-Torsional Buckling
- Flexural Analysis: Lateral-torsional Buckling
- Serviceability Limit State: Deflection, Floor Vibration
- Compression Members - Steel columns
- Beam-Columns Interaction: Members subjected to both Bending and Compression
- Composite Beams: Steel Beam + Concrete over Metal Deck (full and partial composite)
- Steel Frames: Braced and Unbraced Frames
- LFRS (Lateral Force Resisting Systems) - Wind & Earthquake Loads (Introduction only), Rigid Diaphragm;
- Structural Fasteners - Bolted and Welded Connections
- Steel Detailing, Design Economy/Constructability
Course Structure

The class will be comprised of 14 sessions of Lectures, one Workshop session for discussion on the design and analysis of Project Building - a 16-story steel building located in New York City, Miami, or Los Angeles and three (3) exams.

Readings

The required text for the course is:

References:
3. Steel Structures: Controlling Behavior through Design, Robert Englekirk, John Wiley
4. Design of Steel Structures, Gaylord, Gaylord, Stallmeyer, McGraw Hill
5. Building Code 2014 New York City and/or ASCE 7-15 (7-10 & 7-05 acceptable)

The governing “code” or the Specification for steel structures is AISC Steel Construction Manual by American Institute for Steel Construction (AISC); therefore it is necessary to have this specification for the class. However, some relevant code requirements are cited in the textbook and students may supplement the balance from Internet and/or through other means.

Even with a good understanding on course theory, it’s not guaranteed that you can solve practical engineering problems. Structural steel as applied to the building industry is very much advanced in the US and unique in the world in its sophistication and experiences. Equally important is the fact that the Specifications are rooted in the US Customary Units, and their straightforward conversion to SI Units or Metric are often “meaningless” in real life practices. Students must prepare themselves for a sound “structure sense” and hands-on work attitude as a first step for the course.

Course requirements

Class preparation and in-class participation are important for this course and will be factored into your final grade. Students must read required text and articles in advance and be prepared for class Question/Answer drills throughout the session. In addition to class participation, students will analyze and design a real-life 16-story steel building, take one in-class diagnostic mini-midterm exam, one full-fledged midterm exam, and one final exam. Design calculations and drawings for the Project Building shall also be submitted no later than the final exam day.

1st Mini-midterm Exam (1-1/4 hour), October 5 (10% of final grade)
This will be a close-book exam with one formula info sheet permitted. The purpose of the exam is diagnostic in nature. The course work is demanding in knowledge of structural engineering and design. Students with poor performance are advised to come out with detailed study program to better prepare themselves for the course. Or, in certain special cases, advised to withdraw.
Midterm Examination (2-hour), November 2 (20% of final grade)
This will be a timed, close-book examination which will cover all topics up to date. Two (2) formula info sheets are permitted during the exam.

Final Examination (2 ½ -hour), December 21 (40% of final grade)
This will be a timed, close-book examination with 3 info-sheets permitted.

Homework & Special Assignment - due one week after assigned (15% of final grade)
Homework problems will be assigned weekly during each lecture session. It is important to do your homework on a timely basis. Homework must use Microsoft Word engineering typing (or MathCAD), Excel, and AutoCAD. There’s no copying of other’s work and no lending of work to others. No late homework is permitted. Three (3) missing homework and/or absence from class will result in a failure grade. Hardcopy of homework is due a week after it’s assigned and shall be email-able. You are asked to email your homework or assignment by Monday for professor’s preview and comment.

Building Project - Design and Analysis of a 16-story office building (10% of final grade)
The building project builds on the subjects discussed in the lectures, and the analysis/design runs parallel to each lecture topic. Students will submit interim design/analysis results as special assignment. At the end of the semester, students are required to submit a hard copy Term Design Package no later than the final exam date. Giving up on the Building Project Term Design Package is not acceptable, and will result in a penalty of -10%.

Question-and-Answer Drills during class lectures (5% of final grade)
Class preparation and participation are important for this course. The Q/A drills also prepare students to learn “quick response” or to “think on feet” for the real-life requirements of engineering/construction industry.

Lecture Sessions

Sep 7    Introduction - Structural Engineering & Design, US Steel Design, ASD vs. LRFD
         • Salmon et al Chapters 1 & 2

Sep 14   Steel Beams – Local Buckling, Beams Laterally Braced
         • Salmon et al Chapter 7

Sep 21   Steel Beams - Lateral-Torsional Buckling (LTB); Serviceability Consideration - Deflection
         • Salmon et al Chapter 9 & 7

Sep 28   1st Mini-midterm Examination (one hour 15 minutes);
         Steel Columns - Compression Members

Oct 5    Review of Mini-test Results (one hour); Compression Members (continued)
         • Salmon et al Chapter 6
Oct 12  Fall Recess (No Class)

Oct 19  Beam-Column Interaction: Combined Bending and Axial Compression
        •  Salmon et al Chapter 12

Oct 26  Beam-column: Moment Magnifiers (with or without Sidesway)
        •  Salmon et al Chapter 12

Nov 2   Midterm Examination (2 hours); Brief review of Exam Problems

Nov 4 – Tentative – Review of Mid-Term Exam Results

Nov 9   Composite Beams (full and partial composite action), Serviceability Consideration - Floor Vibration
        •  Salmon et al Chapter 16 and References 2 and 3

Nov 16  Frames - Braced and Unbraced, Diaphragm, Lateral Force Resisting Systems
        •  Salmon et al Chapter 14

Nov 23  Thanksgiving (No Class)

Nov 30  Frames (continued). Workshop on Project Building Design & Analysis with Emphasis on Lateral Loads Design
        •  Salmon et al Chapter 14; Professor Lou’s lecture notes

Dec 7   Structural Fasteners - Bolted and Welded Connections
        •  Salmon et al Chapter 4

Dec 14  Connections; Detailing; Steel Design Economy & Constructability
        •  Chapter 4; Professor Lou’s lecture notes and AISC Steel Detailing Manuals

Dec 21  Final Exam and Project Design Package Due

Moses Center Statement of Disability

If you are student with a disability who is requesting accommodations, please contact New York University’s Moses Center for Students with Disabilities (CSD) at 212-998-4980 or mosescsd@nyu.edu. You must be registered with CSD to receive accommodations. Information about the Moses Center can be found at www.nyu.edu/csd. The Moses Center is located at 726 Broadway on the 2nd floor.
NYU School of Engineering Policies and Procedures on Academic Misconduct

A. Introduction: The School of Engineering encourages academic excellence in an environment that promotes honesty, integrity, and fairness, and students at the School of Engineering are expected to exhibit those qualities in their academic work. It is through the process of submitting their own work and receiving honest feedback on that work that students may progress academically. Any act of academic dishonesty is seen as an attack upon the School and will not be tolerated. Furthermore, those who breach the School’s rules on academic integrity will be sanctioned under this Policy. Students are responsible for familiarizing themselves with the School’s Policy on Academic Misconduct.

B. Definition: Academic dishonesty may include misrepresentation, deception, dishonesty, or any act of falsification committed by a student to influence a grade or other academic evaluation. Academic dishonesty also includes intentionally damaging the academic work of others or assisting other students in acts of dishonesty. Common examples of academically dishonest behavior include, but are not limited to, the following:

1. Cheating: intentionally using or attempting to use unauthorized notes, books, electronic media, or electronic communications in an exam; talking with fellow students or looking at another person’s work during an exam; submitting work prepared in advance for an in-class examination; having someone take an exam for you or taking an exam for someone else; violating other rules governing the administration of examinations.

2. Fabrication: including but not limited to, falsifying experimental data and/or citations.

3. Plagiarism: intentionally or knowingly representing the words or ideas of another as one’s own in any academic exercise; failure to attribute direct quotations, paraphrases, or borrowed facts or information.

4. Unauthorized collaboration: working together on work that was meant to be done individually.

5. Duplicating work: presenting for grading the same work for more than one project or in more than one class, unless express and prior permission has been received from the course instructor(s) or research adviser involved.

6. Forgery: altering any academic document, including, but not limited to, academic records, admissions materials, or medical excuses.