Western University - Faculty of Engineering
Department of Civil and Environmental Engineering

CEE3346b - Steel Design - Course Outline 2016/17

Introduction

This is the final lecture-based structural design course in the Civil/Structural options, and synthesizes material taken in previous structural design and analysis courses. The general objectives are for the student to become able to

- identify, formulate and solve problems involving structural steel while working individually or functioning on a team;
- recognise that the essential criteria in CSA Standard CAN/CSA-S16-09 ("Limit States Design of Steel Structures"), that address the design of steel members and structures, are simple and direct applications of the fundamentals of statics and applied mechanics;
- rapidly design steel structures, components and connections in accordance with the provisions of CSA Standard CAN/CSA-S16-14;
- improve communication skills by documenting decisions made during the design process in coherent and legible design calculations;
- appreciate professional responsibility issues in steel design and construction, and
- recognise the need for life-long learning to keep abreast of new design and construction methods, and to enhance one's abilities as a designer.

Calendar Copy:

Behaviour and Limit States Design of tension members, columns, beams, beam-columns and connections. P-delta analysis for unbraced frames. Building systems. Current professional issues in steel construction. Health and safety issues are discussed.

Prerequisites:

CEE3340a

Corequisites:

None.

Antirequisites:

None.

Note: It is the **student's responsibility** to ensure that all Prerequisite and Corequisite conditions are met or that special permission to waive these requirements has been granted by the Faculty. It is also the **student's responsibility** to ensure that they have not taken a course listed as an Antirequisite. The student may be dropped from the course or not given credit for the course towards their degree if they violate the Prerequisite, Corequisite or Antirequisite conditions.

Contact Hours:

3 lecture hours per week; 3 tutorial hours per week.

Attendance of the tutorial session is **mandatory**

Instructor:

Dr. Wenxing Zhou, P. Eng.

E-mail: wzhou@eng.uwo.ca
Phone: ext. 87931
Office: CMLP1303
Office hour: Friday, 2 - 3 PM
Administrative support: SEB3005

Textbook:
Handbook of Steel Construction, Eleventh (11th) Edition, Canadian Institute of Steel Construction (CISC), 2016, (including CAN/CSA-S16-14 Code and Commentary), to be purchased from Amazon.ca, the exclusive vendor for the CISC Handbook. Use the following link: https://www.amazon.ca/CISC-Handbook-Steel-Construction-Printing/dp/0888112033/ref=sr_1_1?ie=UTF8&qid=1481919306&sr=8-1&keywords=handbook+of+steel+construction. Note that each student will be provided a **unique promo code** that is valid for the **one-time purchase of one Handbook** and **must be used between December 20, 2016 and January 31, 2017**.

Prepared course notes, available on OWL, shall be brought to each class.

Other References:

Limit States Design in Structural Steel, by Kulak and Grondin, 10th Edition, CISC, 2016. Purchase optional

Other excellent structural steel references are available in the Taylor Library, or online at www.cisc-icca.ca.

Units:
SI units will be used in lectures, tutorials and examinations

Specific Learning Objectives:

1. Identification and Properties of Steel and Steel Sections:
   a) Identify mechanical properties of steel: yield strength, toughness.
   b) Identify Canadian and American steel grades.
   c) Identify and determine properties of commonly-used rolled sections.
   d) Calculate properties of built-up sections

2. Limit States Design Concepts
   a) Classify limit states as Ultimate, Fatigue or Serviceability Limit States.

3. Load Paths in Structures
   a) Visualize gravity load paths, and so calculate tributary areas.
   b) Visualize lateral load paths, and so calculate force effects in diaphragms, bracing, and moment-resisting frames.

4. Tension Members
   a) Analyse tension members to determine capacity based on yield of the gross section or fracture of the net section accounting for staggered holes and shear lag.
   b) Design tension members to satisfy both Serviceability and Ultimate Limit States.

5. Simple Columns
   a) Determine the axial capacity of short, long, and intermediate columns using CSA S16-14.
   b) Design simple columns for factored loads at Ultimate Limit States, using first principles or tables in the *CISC Handbook*.

6. Laterally Supported Beams
   a) Calculate moment-curvature relationship for W and rectangular sections.
   b) Determine class of section, and equation defining flexural capacity, based on local buckling (b/t and h/w) considerations.
   c) Design beams for shear forces and bending moments at Serviceability and Ultimate Limit States, using first principles or tables in CISC Handbook.

7. Laterally Unsupported Beams
   a) Calculate the elastic lateral-torsional buckling capacity of a laterally-unsupported beam subjected to uniform or non-uniform applied moments.
   b) Design laterally-unsupported beams, using tables in the CISC Handbook.

8. Composite Construction
   a) Identify effect of construction method on behaviour of composite sections.
   b) Calculate moment resistance of composite section at Ultimate Limit State.

9. Stability Concepts
   a) Distinguish between first- and second-order analyses.
   b) Identify effect of deformations on the behaviour of a member or a structural system.
   c) Determine the sway amplification factor for single-storey structures using CSA S16-14.

10. Beam Columns
   a) Analyse cross section for combination of axial tension and bending moment.
   Determine capacity for combination of axial compression and bending moment as limited by local buckling, cross-section strength, member strength based on in-plane behaviour, and member strength based on lateral-torsional buckling.
   c) Calculate beam-column capacity rapidly using tables in the CISC Handbook.

11. Fasteners
   a) Identify common types of bolts, and installation methods.
   b) Determine number and arrangement of bolts to resist shear, tension, and combined shear and tension at Serviceability and Ultimate Limit States using CSA S16-14.
   c) Rapidly design fasteners using tables in the CISC Handbook

Examinations and Quizzes:

1). Two one-hour **Open Book** Quizzes will be scheduled from **9:30 to 10:30 am** on **February 15** and **March 15, 2017, respectively**, in the first hour of the tutorial period. Should either of these dates conflict with a religious holiday that a student wishes to observe, the student must inform the instructor of the conflict no later than two weeks before the scheduled test. (For further information on Accommodations for Religious Holidays see http://www.uwo.ca/univsec/handbook/appeals/religious.pdf.

2). One 3-hour **Open Book** Final Examination.

No programmable calculators or other external sources of information, including books, notes or crib sheets, are permitted in either the quizzes or final exam. A list of acceptable calculators for closed book exams will be posted on the bulletin board across from the Department of Civil and Environmental Engineering Office: please be sure your calculator is on it!

Assignments

One solution to Part A of each weekly assignment must be turned in by each group by the end of the tutorial period. Group membership will be assigned by the Instructor, and may be revised once during the term.

All group members must sign the cover page of group submissions. The **Instructor will designate the group member responsible for preparing each group submission.** Each student must turn in one solution to Part B of each weekly assignment at 9:30 am on **Wednesday mornings in Locker 66, Second Floor, Spencer Engineering Building -** or bring to the tutorial that morning. Late assignments will receive a grade of zero. Extensions are to be negotiated with the Course Instructor, not the Teaching Assistants.

Evaluation

The final grade is computed as follows:

Tutorial Problems & Assignments	30%
Quizzes	20%
Final	50%
TOTAL	100%

a). **Students must pass the final examination to pass this course**. Students who fail the final examination will be assigned the aggregate mark, as determined above or 48%, whichever is less.

b). **Students must turn in all assignments and achieve a passing grade, to pass this course**. Students who do not satisfy this requirement will be assigned 48% or the aggregate mark whichever is less.

English

In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests and examinations for the improper use of English. Additionally, poorly written work with the exception of final examinations may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

General Learning Objectives

Knowledge Base	E	Team Work	T	Economics and Project Management	
Problem Analysis	T	Communication	T	Life-Long Learning	I
Investigation		Professionalism	T		
Design	E	Impact on Society	I		
Engineering Tools	E	Ethics and Equity			

Plagiarism Checking:

The University of Western Ontario uses software for plagiarism checking. Students are required to submit their Laboratory Reports in electronic form to Turnitin.com for plagiarism checking.

Cheating:

University policy states that cheating is a scholastic offence. The commission of a scholastic offence is attended by academic penalties that might include expulsion from the program. If you are caught cheating, there will be no second warning.

For more information on scholastic offenses, please see:
http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_undergrad.pdf

Attendance:

Any student who, in the opinion of the instructor, is absent too frequently from class, laboratory, or tutorial periods will be reported to the Dean (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Dean, the student will be debarred from taking the regular final examination in the course.

Accessibility:
Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.

Conduct:
Students are expected to arrive at lectures on time, and to conduct themselves during class in a professional and respectful manner that is not disruptive to others. Late comers may be asked to wait outside the classroom until being invited in by the Instructor. Please turn off your cell phone before coming to a class, tutorial, quiz or exam.

On the premises of the University or at a University-sponsored program, students must abide by the Student Code of Conduct: http://www.uwo.ca/univsec/board/code.pdf

Sickness and Other Problems:
Students should immediately consult with the Instructor or Department Chair if they have any problems that could affect their performance in the course. Where appropriate, the problems should be documented (see attached). The student should seek advice from the Instructor or Department Chair regarding how best to deal with the problem. Failure to notify the Instructor or Department Chair immediately (or as soon as possible thereafter) will have a negative effect on any appeal.

For more information concerning medical accommodations, please see:
http://www.uwo.ca/univsec/handbook/appeals/accommodation_medical.pdf

Notice:
Students are responsible for regularly checking their email, course website (https://owl.uwo.ca) and notices posted outside the Civil and Environmental Engineering Department Office

Consultation:
Students are encouraged to discuss problems with their teaching assistant and/or instructor in tutorial sessions. Office hours will be arranged for the students to see the instructor and teaching assistants. Other individual consultation can be arranged by appointment with the appropriate instructor.

Course Breakdown
Engineering Design = 100% or 58.5 AU's

The document "INSTRUCTIONS FOR STUDENTS UNABLE TO WRITE TESTS OR EXAMINATIONS OR SUBMINT ASSIGNMENTS AS SCHEDULED" is part of this course outline.

INSTRUCTIONS FOR STUDENTS UNABLE TO WRITE TESTS OR EXAMINATIONS OR SUBMIT ASSIGNMENTS AS SCHEDULED

If, on medical or compassionate grounds, you are unable to write term tests or final examinations or complete course work by the due date, you should follow the instructions listed below. You should understand that academic accommodation will not be granted automatically on request. You must demonstrate to your department (or the Undergraduate Services office if you are in first year) that there are compelling medical or compassionate grounds that can be documented before academic accommodation will be considered. Different regulations apply to term tests, final examinations and late assignments. Read the instructions carefully. (see the 2016 Western Academic Calendar).

A. *GENERAL REGULATIONS & PROCEDURES*

1. Check the course outline to see if the instructor has a policy for missed tests, examinations, late assignments or attendance.
2. Bring your request for academic accommodation to the attention of the Chair of the department (or the Undergraduate Services office if you are in first year) prior to the scheduled time of the test or final examination or due date of the assignment. If you are unable to contact the relevant person, leave a message with the appropriate department (or Undergraduate Services office, if you are in first year). The addresses, telephone and fax numbers are given at the end of these instructions. Documentation must be provided as soon as possible.
3. If you decide to write a test or an examination you should be prepared to accept the mark you earn. Rewriting tests or examinations or having the value of a test or exam reweighted on a retroactive basis is not permitted.

B. *TERM TESTS*

1. If you are unable to write a term test, inform your instructor and the Chair of your Department (or the Undergraduate Services Office if you are in first year) prior to the scheduled date of the test. If the instructor is not available, leave a message for him/her at the department office and inform the Chair of the Department (or the Undergraduate Services Office if you are in first year).
2. Be prepared to provide supporting documentation to the Chair and the Undergraduate Services Office (see next page for information on documentation).
3. Discuss with the instructor if and when the test can be rescheduled. **N.B.** The approval of the Chair (or the Undergraduate Services Office if you are in first year) is required when rescheduling term tests.

C. *FINAL EXAMINATIONS*

1. If you are unable to write a final examination, contact the Undergraduate Services Office PRIOR TO THE SCHEDULED EXAMINATION TIME to request permission to write a Special Final Examination. If no one is available in the Undergraduate Services Office, leave a message clearly stating your name & student number (please spell your full name).
2. Be prepared to provide the Undergraduate Services Office with supporting documentation (see next page for information on documentation) the next day, or as soon as possible (in cases where students are hospitalized). The following circumstances are not considered grounds for missing a final examination or requesting special examinations: common cold, sleeping in, misreading timetable and travel arrangements.
3. In order to receive permission to write a special examination, you must obtain the approval of the Chair of the Department **and** the Associate Dean and in order to apply you must sign a "Recommendation for a Special Examination Form" available in the Undergraduate Services Office. The Undergraduate Services Office will then notify the course instructor(s) and reschedule the examination on your behalf.

***N.B.* It is the student's responsibility to check the date, time and location of the special examination.**

D. *LATE ASSIGNMENTS*

1. Advise the instructor if you are having problems completing the assignment on time (**prior** to the due date of the assignment).
2. Be prepared to provide documentation if requested by the instructor (see reverse side for information on documentation).
3. If you are granted an extension, establish a due date. The approval of the Chair of your Department (or the Associate Dean if you are in first year) is not required if assignments will be completed prior to the last day of classes.
4. i) Extensions beyond the end of classes must have the consent of the instructor, the department Chair and the Associate Dean. Documentation is mandatory.
ii) A Recommendation of Incomplete Form must be filled out indicating the work to be completed and the date by which it is due. This form must be signed by the student, the instructor, the department Chair and the Associate Dean.

SHORT ABSENCES

If you miss a class due to a minor illness or other problems, check your course outlines for information regarding attendance requirements and make sure you are not missing a test or assignment. Cover any readings and arrange to borrow notes from a classmate.

EXTENDED ABSENCES

If you are absent more than one week or if you get too far behind to catch up, you should consider reducing your workload by dropping one or more courses. (Note drop deadlines listed below). You may want to seek advice from the academic counsellor in your Department or the counsellors in the Undergraduate Services Office if you are in first year.

DOCUMENTATION

If you consulted an off-campus doctor or Student Health Services regarding your illness or personal problem, you must provide the doctor with a Student Medical Certificate to complete at the time of your visit and then bring it to the Department (or the Undergraduate Services Office if you are in first year). **This note must contain the following information: severity of illness, effect on academic studies and duration of absence.**

In Case of Serious Illness of a Family Member*:* Provide a Student Medical Certificate to your family member's physician to complete and bring it to the Department (or the Undergraduate Services Office if you are in first year).

In Case of a Death: Obtain a copy of the death certificate or the notice provided by the funeral director's office. You must include your relationship to the deceased and bring it to the Department (or the Undergraduate Services Office if you are in first year).

For Other Extenuating Circumstances: If you are not sure what documentation to provide, ask the Departmental Office (or the Undergraduate Services Office if you are in first year) for direction.

Note: Forged notes and certificates will be dealt with severely. To submit a forged document is a scholastic offence (see below).

ACADEMIC CONCERNS

You need to know if your instructors have a policy on late penalties, missed tests, etc. This information may be included on the course outlines. If not, ask your instructor(s).

You should also be aware of attendance requirements in some courses. You can be debarred from writing the final examination if your attendance is not satisfactory.

If you are in academic difficulty, check out the minimum requirements for progression in the calendar. If in doubt, see your academic counsellor.

Calendar References: Check these regulations in your 2016 Western Academic Calendar available at www.westerncalendar.uwo.ca.

Absences Due to Illness - page 117
Academic Accommodations for Students with Disabilities - page 118
Academic Accommodations for Religious Holidays - page 119
Incomplete Standing - page 104
Scheduling of Term Assignments – page 97
Scholastic Offences - page 113
Special Examinations - page 132

Note: These instructions apply to all students registered in the Faculty of Engineering regardless of whether the courses are offered by the Faculty of Engineering or other faculties in the University.

Drop Deadlines**:** First term half course (i.e. “A” or “F”): November 5, 2016
Full courses and full-year half courses (i.e. “E”, “Y” or no suffix): November 30, 2016
Second term half or second term full course (i.e. “B” or “G”): March 7, 2017

Undergraduate Services Office: SEB 2097 telephone: (519) 661-2130 fax: (519) 661-3757
Dept. of Chemical and Biochemical Engineering: TEB 477 telephone: (519) 661-2131 fax: (519) 661-3498
Dept. of Civil and Environmental Engineering: SEB 3005 telephone: (519) 661-2139 fax: (519) 661-3779
Dept. of Electrical and Computer Engineering, Software Engineering
Mechatronics Engineering TEB 279 telephone: (519) 661-3758 fax: (519) 850-2436
Dept. of Mechanical and Materials Engineering: SEB 3002 telephone: (519) 661-4122 fax: (519) 661-3020