

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

**CEE 9515b/3346b – Steel Design – Course Outline
2015/16**

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-S16-09;
- 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:

CEE 3340a.

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.

Corequisites:

None

Antirequisites:

None

Contact Hours:

3 lecture hours/week; 3 design laboratory/tutorial hours; (personal study - 4 hours). Attendance at the tutorial/laboratory session is **mandatory**.

Course Instructor:

Dr. F. M. Bartlett, P. Eng., SEB 2097A, email: f.m.bartlett@uwo.ca.
Administrative Support: Room SEB 3005

Units:

SI Units will be used in lectures and examinations.

Textbook:

Handbook of Steel Construction, Tenth Edition, Canadian Institute of Steel Construction, 2010, (includes CAN/CSA-S16-09 Code and Commentary), to be purchased directly from the CISC - \$140 plus shipping and applicable taxes (not the \$280 rate. Order online from <http://www.cisc-icca.ca/solutions-centre/publications/publications>, click on the book to add it to your cart, and include the promo code **Rhzbmak6Xhpm** on the order form to get the discounted price.)

Prepared class notes (Version 5.5), available on OWL Sakai, should be brought to each class.

Other References:

Limit States Design in Structural Steel, by Kulak and Grondin, Canadian Institute of Steel Construction, Ninth Edition, 2010 (purchase optional).

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

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
- e) Avoid misuse of information on mill (quality control) certificates.

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. 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*.

5. 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*.

6. Composite Construction

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

7. Simple Columns

- a) Determine the axial capacity of short, long, and intermediate columns using CSA S16-09.
- b) Design simple columns for factored loads at Ultimate Limit States, using first principles or tables in the *CISC Handbook*.

8. Beam Columns

- a) Analyse cross section for combination of axial tension and bending moment.

- b) 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*.

9. 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.

10. 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 S16-09.
- c) Rapidly design fasteners using tables in the *CISC Handbook*

11. Stability of Frames

- 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 S16-09.

12. Cost Estimating

- a) Estimate costs of steel fabrication using CISC Estimating Method
- b) Identify cost-saving features of design – simplicity, repetitiveness.

Evaluation:

The final course mark will be determined as follows:

Weekly Assignments:	30%
Quizzes:	20%
Lecture Participation (Bonus)	5%
Final Exam:	50% or 100% – see Note 2

Total	100%

Note: 1. **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 the examination mark, whichever is less.

- 2. The final grade for students who pass the final examination ***and participate in all group assignments*** will be the aggregate mark or the examination mark, whichever is greater.

1. Quiz and Examination:

Two 50-minute quizzes will be scheduled during the term, on 01 February 2016 and 07 March 2016, 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 18 January 2016. (See <http://www.uwo.ca/univsec/handbook/appeals/religious.pdf>).

Both the quiz and the final exam are **OPEN BOOK**.

2. Weekly 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 will be revised at least 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 Monday 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.

3. Use of English

In accordance with Senate and Faculty Policy, students may be penalised 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 the final examination 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.

CEAB Accreditation General Learning Objectives

Summary

(I = Introduce, T = Teach, E = Evaluate, all at Advanced Level)

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

Details

Criterion	Application in CEE 3346
Problem Analysis	** ability to use appropriate knowledge and skills to identify, formulate, analyse and solve complex engineering problems
Investigation	(not really in CEE 3346: one demonstration, no labs)
Design	*** ability to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards...
Use of Engineering Tools	*** Ability to create, select, apply and extend appropriate techniques, resources, and modern engineering tools to a range of engineering activities
Team Work	** Ability to work effectively as a member and leader in teams...
Communication skills	* Ability to communicate complex engineering concepts within the profession... including... design documentation.
Professionalism	* Understanding of the roles and responsibilities of the professional engineer in society.
Impact of Engineering on Society and the Environment	(not really in CEE 3346: implicit reference to health, safety and legal aspects, a mention of sustainability)
Ethics and equity	(not explicitly in CEE 3346)
Economics and Project Management	(not explicitly in CEE 3346)
Life-long learning	* Ability to identify and address educational needs in a changing world, sufficiently to maintain competence and contribute to advancement of knowledge.

Cheating:

University policy states that cheating and plagiarism are scholastic offences. 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.

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 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.

Sickness and Other Problems:

Students should immediately consult with the Department of Civil and Environmental Engineering if they are ill or have any other 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 concerning the recovery of work missed. Failure to notify the Department of illness or any other matter that could affect academic performance immediately (or as soon as possible thereafter) will have a negative effect on any appeal.

Notice:

Students are responsible for regularly checking their UWO-account email and notices posted outside the Civil and Environmental Engineering Department Office.

Consultation:

Students are encouraged to discuss problems with their Teaching Assistants 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 Instructor, preferably initiated by an electronic mail communication.

Course breakdown:

Engineering Design = 100% or 58.5 AU's.

The document “*INSTRUCTIONS FOR STUDENTS UNABLE TO WRITE TESTS OR EXAMINATIONS OR SUBMIT ASSIGNMENTS AS SCHEDULED*”, attached, is to be considered part of this course outline.

Western University - Faculty of Engineering
2015-2016

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) 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 2015 UWO ACADEMIC CALENDAR).

A. GENERAL REGULATIONS & PROCEDURES

1. All first year students will report to the Undergraduate Services Office, SEB 2097, for all instances.
2. If you are an upper year student and you are missing a test/assignment/lab or exam that is worth MORE THAN 10% of your final grade, you will report to the Undergraduate Services Office, SEB 2097. Otherwise, you will report to your department office to request accommodation.
3. Check the course outline to see if the instructor has a policy for missed tests, examinations, late assignments or attendance.
4. Documentation must be provided as soon as possible. If no one is available in your Department office or the Undergraduate Services Office, leave a message clearly stating your name & student number and reason for your call. The department telephone numbers are given at the end of these instructions.
5. 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 examination reweighted on a retroactive basis is not permitted.

B. TERM TESTS

1. If you are in first year and you are unable to write a term test, contact the Undergraduate Services Office, SEB 2097 PRIOR to the scheduled date of the test.
2. If you are an upper year student and you are unable to write a term test, inform your instructor PRIOR to the scheduled date of the test. If the instructor is not available, leave a message for him/her at the department office. If the test is worth MORE THAN 10% of your final grade you will report to the Undergraduate Services Office, SEB 2097 to request accommodation. Otherwise, you will report to your department office to request accommodation.
3. Be prepared to provide supporting documentation to the Department Chair and/or the Undergraduate Services Office (see next page for information on documentation).
4. Discuss with the instructor if and when the test can be rescheduled. **N.B.** The approval of the Chair or the Undergraduate Services Office 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.
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.

E. 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.

F. 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 your Academic Counsellor in the Undergraduate Services Office.

G. 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). **This note must contain the following information: severity of illness, effect on academic studies and duration of absence. Regular doctors notes will not be accepted; only the Student Medical Certificate will be accepted.**

- **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.
- **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.
- **For Other Extenuating Circumstances:** If you are not sure what documentation to provide, ask the Departmental Office for direction.

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

H. ACADEMIC CONCERNS

1. 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).
2. **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.**
3. 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 2015 Western Academic Calendar available at www.westerncalendar.uwo.ca.

Absences Due to Illness: <http://www.westerncalendar.uwo.ca/2015/pg117.html>

Academic Accommodations for Students with Disabilities: <http://www.westerncalendar.uwo.ca/2015/pg118.html>

Academic Accommodations for Religious or Holy Days: <http://www.westerncalendar.uwo.ca/2015/pg118.html>

Course Withdrawals: <http://www.westerncalendar.uwo.ca/2015/pg157.html>

Examinations: <http://www.westerncalendar.uwo.ca/2015/pg129.html>

Scheduling of Term Assignments: <http://www.westerncalendar.uwo.ca/2015/pg97.html>

Scholastic Offences: <http://www.westerncalendar.uwo.ca/2015/pg113.html>

Student Medical Certificate: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf

Engineering Academic Regulations: <http://www.westerncalendar.uwo.ca/2015/pg1442.html>

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:

Second term half or second term full course (i.e. "B" or "G"): March 7, 2016

Contact Information:

Undergraduate Services Office: SEB 2097 Telephone: (519) 661-2130

Dept. of Civil and Environmental Engineering: SEB 3005 Telephone: (519) 661-2139

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