

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

**CEE3346b - Steel Design - Course Outline 2024/25**

**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 CSA-S16-19 (“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 CSA-S16-19;
- 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/B

**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/week**

Lectures will be organized into learning modules, which students should review on a weekly basis. Review of lecture material and self-study should take approximately 6 hours per week.

**3 tutorial hours/week**

Weekly assignments will be distributed during the tutorials.

**Instructor:**

Dr. Wenxing Zhou, P. Eng.

E-mail: [wzhou@eng.uwo.ca](mailto:wzhou@eng.uwo.ca)

Office hour:

- By appointment
- Students are also encouraged to set up appointment for office hours with Tas – the TA contact information will be provided in OWL.

**Textbook:**

- *Handbook of Steel Construction*, 12<sup>th</sup> Edition, 2<sup>nd</sup> Printing, Canadian Institute of Steel Construction (CISC), 2023, (including CSA-S16-19 Code and Commentary). **Purchase of the Handbook is required.** Instructions for purchasing the book at a discounted price (\$194.50 + tax) are posted on the course OWL site.
- Prepared course notes, posted on OWL, required.

**Other References:**

*Limit States Design in Structural Steel*, by Kulak and Grondin, 11<sup>th</sup> Edition, CISC, 2021. **Purchase optional**  
Other excellent structural steel references are available in the Taylor Library, or online at [www.cisc-icca.ca](http://www.cisc-icca.ca).

**Units:**

SI units will be used in lectures, tutorials and examinations

**Specific Learning Objectives [GA indicators – bold represents evaluated indicators]:**

1. Identification and Properties of Steel and Steel Sections (Week 1) [KB4, PR1, CS1, D1, D4]:
  - 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 (Week 2) [KB4, CS1, LL1, ITW1, D1]
  - a) Classify limit states as Ultimate, Fatigue or Serviceability Limit States.
3. Load Paths in Structures (Weeks 2-3) [PA1, KB4, D4]
  - 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 (Week 3-4) [KB4, PR1, D1, D4, ET2]
  - 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 (Week 4-5) [KB4, PA2, PR1, D1, D4, **ET2**]
  - a) Determine the axial capacity of short, long, and intermediate columns using CSA S16-19.
  - b) Design simple columns for factored loads at Ultimate Limit States, using first principles or tables in the *CISC Handbook*.
6. Laterally Supported Beams (Weeks 5-6) [KB4, PA2, PR1, D1, D4, **ET2**]
  - 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 (Weeks 7-8) [KB4, PA2, PR1, D1, D4, **ET2**]
  - 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 (Weeks 9-10) [KB4, CS1, PA2, PR1, D1, **D4**]
  - 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 (Week 11) [KB4, PA2, PR1, **D1**, D4]
  - 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 S16-19.
10. Beam Columns (Week 12) [KB4, PA2, PR1, D1, D4, ET2]
  - 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 (if time permits) [KB4, PA2, PR1, D1, D4, ET2]
  - 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 S16-19.
  - c) Rapidly design fasteners using tables in the CISC Handbook

The instructor may expand or revise material presented in the course as appropriate.

**General Learning Objectives**

Knowledge Base	T	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			

## Evaluation

The final grade is computed as follows:

Participation	5%
Assignments	25%
Quizzes	20%
Final exam	<u>50%</u>
TOTAL	100%

**Note:** **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.

Students who have failed this course previously must repeat all components of the course. No special permissions will be granted enabling a student to retain laboratory, assignment or test marks from previous years. Previously completed assignments and laboratories cannot be resubmitted.

### **1. Examinations and Quizzes:**

Two one-hour quizzes will be held during tutorial hours. These quizzes are tentatively scheduled on **Friday, February 28, 2025 and Friday, March 21, 2025**. The classrooms for the quizzes will be announced in due course.

A three-hour written final examination will be held during the regular examination period.

Both the quizzes and final examination will be **open book** exams.

### **2. Assignments**

Assignments will be distributed on a weekly basis. Each student must complete the assignment and submit the solution **electronically through OWL – Brightspace** by the due date specified. Discussions with classmates during the tutorial session to complete the assignment are encouraged. While the solutions to ALL of the questions in each assignment will be posted on OWL, **only a selection of questions in each assignment will be marked** – the questions to be marked will not be determined or announced in advance. The intention is for students to complete the entire assignment to learn as much as possible the course materials.

### **3. Participation:**

Participation will be assessed based on class attendance, participation in lectures and tutorials and completion of short in-class assessments.

#### **I. Missed/Late Accommodation Policy:**

1. Students missing a test/assignment/lab or examination will report the absence by submitting Academic Consideration Request form through [STUDENT ABSENCE PORTAL](#).
2. Documentation must be provided as soon as possible.

#### **II. Exam Accommodation:**

1. If you are unable to write a final examination, report your absence using the Academic Consideration Request Form through [STUDENT ABSENCE PORTAL](#).
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, headache, 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 submit an Academic

Consideration Request Form through [STUDENT ABSENCE PORTAL](#).

PLEASE NOTE: It is the student's responsibility to check the date, time and location of the Special Examination.

### III. Late Assignments:

1. Students must advise the course instructor if they are having difficulty completing an assignment on time (prior to the due date of the assignment).
2. Students should be prepared to submit the Academic Consideration Request Form and provide documentation if requested to do so by the course instructor (see reverse side for information on documentation).
3. If granted an extension, a revised due date should be established with the course instructor. The approval of the Chair of your Department (or the Assistant Dean, First Year Studies, if you are in first year) is not required if assignments will be completed prior to the last day of classes.
4. This course has 8 assignments with **only 6/8 assignments** counted towards your final grade. Academic consideration will not be granted for missed assignments. If a student misses 2 out of the 8 assignments, the remaining assignments will be used in the calculation of their final grade. If a student misses more than 2 assignments, they will receive a grade of zero on each additional missed assignment starting with the third.
5. This course employs flexible deadlines for assignments. The assignment deadlines can be found in the assignment question sheet. For each assignment, students are expected to submit the assignment by the deadline specified. Should illness or extenuating circumstances arise, students are permitted to submit their assignment up to 72 hours past the deadline without academic penalty. Should students submit their assessment beyond 72 hours past the deadline, they will receive a zero grade for the assignment. As flexible deadlines are used in this course, requests for academic consideration will not be granted. If you have a long-term academic consideration or an accommodation for disability that allows greater flexibility than provided here, please reach out to your instructor at least one week prior to the posted deadline.
6. Extensions beyond the end of classes must have the consent of the instructor, the department Chair and the Associate Dean, Undergraduate Studies. Documentation is mandatory.

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

### IV. Medical Accommodation:

1. Requests for Academic Consideration Request Form through [STUDENT ABSENCE PORTAL](#).
2. Requests for academic consideration must include the following components:
  - a. Self-attestation signed by the student (*This is only accepted for the first/one absence*)
  - b. Medical note
  - c. Indication of the course(s) and assessment(s) affected by the request
  - d. Supporting documentation as relevant
3. Requests without supporting documentation are limited to one per term per course.
4. Students must request academic consideration as soon as possible and no later than 48 hours after the missed assessment.
5. Once the request and supporting documents have been received and reviewed, appropriate academic consideration, if granted, shall be determined by the instructor in consultation with the academic advisor, in a manner consistent with the course outline. Academic consideration may include extension of deadlines, waiver of attendance requirements for classes/labs/tutorials, or re-weighting of course requirements. Some forms of academic consideration, such as arranging Special Examinations, assigning a grade of Incomplete, or granting late withdrawals without academic penalty, may only be granted by the Academic Advising office of the Faculty of Engineering.

#### **V. Religious Accommodation:**

When scheduling unavoidably conflicts with religious holidays, which (a) require an absence from the University or (b) prohibit or require certain activities (i.e., activities that would make it impossible for the student to satisfy the academic requirements scheduled on the day(s) involved), no student will be penalized for absence because of religious reasons, and alternative means will be sought for satisfying the academic requirements involved. If a suitable arrangement cannot be worked out between the student and instructor involved, they should consult the appropriate Department Chair and, if necessary, the student's Dean.

It is the responsibility of such students to inform themselves concerning the work done in classes from which they are absent and to take appropriate action.

#### **VI. Academic Integrity:**

In the Faculty of Engineering, we encourage students to create a culture of honesty, trust, fairness, respect, responsibility, and courage, befitting the professional degree you are pursuing.

Please visit [Academic Integrity Western Engineering](#) for more information

#### **VII. Academic Offences:**

Plagiarism means using another's work without giving credit. The university has rules against plagiarism and other scholastic offences. Western Engineering has a zero-tolerance policy on plagiarism. The minimum penalty is zero on the course work and a repeat offence will earn you zero on the course. A third offence may lead to expulsion from the university.

[Scholastic Discipline for Undergraduate Students & Cheating, Plagiarism and Unauthorized Collaboration: What Students Need to Know](#)

Students must write their reports, essays and assignments in their own words. Whenever students take an idea or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. University policy states that cheating, including plagiarism, is a scholastic offence. The commission of a scholastic offence is attended by academic penalties, which might include expulsion from the program. If you are caught cheating, there will be no second warning.

All required papers may be subject to submission for textual similarity review to commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted will be included as source documents on the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between the University of Western Ontario and Turnitin.com (<http://www.turnitin.com>). Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, in the relevant section of the Academic Handbook:

[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_undergrad.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf)

#### **VIII. Faculty of Engineering AI Policy:**

The use of generative Artificial intelligence (GenAI) tools won't be discouraged in the Faculty of Engineering. As we pride ourselves on building the future we can't hide from the use of GenAI tools to contribute to the understanding of the course materials. However, the use of GenAI tools in any assignment or contribution during the course will have to be disclosed, as a resource.

GenAI tools use won't be permitted in any type of examination or other assessments where the faculty have prohibited their use. If use of GenAI tools is detected by the instructor in these instances, academic offences penalties might be imposed against the student.

#### **IX. Use of English Policy:**

In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests, and examinations for improper use of English. Additionally, poorly written work except for 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.

#### **X. Accessibility:**

Western is committed to achieving barrier free accessibility for persons with disabilities studying, visiting and working at Western. As part of this commitment, there are a variety of services, groups and committees on campus devoted to promoting accessibility and to ensuring that individuals have equitable access to services and facilities. To help provide the best experience to all members of the campus community, please visit the [Accessibility Western University](#) for information on accessibility-related resources available at Western.

Students with disabilities may arrange for academic accommodation at Western. For a more detailed explanation, please visit [Academic Support & Engagement -Academic Accommodation](#).

#### **XI. Inclusivity, Diversity, and Respect:**

The Faculty of Engineering at Western University is committed to creating equitable and inclusive learning environments that value diverse perspectives and experiences. We recognize that university courses often marginalize students based on social identity characteristics such as, but not limited to, Indigeneity, race, ethnicity, nationality, ability, gender identity, gender expression, sexuality, age, language, religion, and socioeconomic status. Understanding this, we strive to facilitate equitable experiences and inclusion within the classroom by respecting and integrating multiple ways of knowing, being, and doing. Please visit the [Office of Equity, Diversity and Inclusion](#).

#### **XII. Health and Well-Being:**

- [Health & Wellness Services – Students](#) - Offers appointment-based medical clinic for all registered part-time and full-time students.
- [Mental Health Support](#) - Provides professional and confidential services, free of charge, to students needing assistance to meet their personal, social and academic goals. Services include consultation, referral, groups and workshops, as well as brief, change-oriented psychotherapy.
- [Crisis Support](#) - For immediate assistance, please visit Thames Hall Room 2170 or call 519-661-3030. The crisis clinic operates between 11:00 am - 4:30 pm. For after-hours crisis support, click [here](#).
- [Gender-Based Violence and Survivor Support](#) - Western [is committed to reducing incidents of gender-based and sexual violence](#) and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced gender-based or sexual violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts, [here](#). To connect with a case manager or set up an appointment, please contact [support@uwo.ca](mailto:support@uwo.ca).

#### **Important Contacts:**

<a href="#">Engineering Undergraduate Services</a>	SEB 2097	519-661-2130	<a href="mailto:engugrad@uwo.ca">engugrad@uwo.ca</a>
<a href="#">Civil &amp; Environmental Engineering</a>	SEB 3005	519-661-2139	<a href="mailto:civil@uwo.ca">civil@uwo.ca</a>
<a href="#">Office of the Registrar/Student Central</a>	WSSB 1120	519-661-2100	

#### **Important Links:**

- [WESTERN ACADEMIC CALENDAR](#)
- [ACADEMIC RIGHTS AND RESPONSIBILITIES](#)

#### **Course Breakdown: (Values given in accreditation units)**

Engineering Design = 100%