

**CARLETON UNIVERSITY**  
**Department of Civil and Environmental Engineering**

**CIVE 5204 F – Advanced Steel Structures**

**Fall 2022**

**Time: Wednesday 6:00–9:00 pm**

**Place: 3356 ME**

**Instructor: Khoo, H.A.**

**Room 3364 ME**

**Phone 520-2600 Ext. 5798**

**[heng.khoo@carleton.ca](mailto:heng.khoo@carleton.ca)**

**Office Hour:**

**To be determined**

**Objective: This course is intended as an advance course on the theory and behaviour of steel structures. Only a few selected topics on steel structures will be discussed in this course.**

**Course Outline:**

1. Design Philosophy and Material Properties
2. Tension Members
3. In-plane Differential Equation
4. Torsion  
St. Venant Torsion, warping torsion of W-section, solution of torsion problems
5. Second Order Differential Equation
6. Axially Loaded Columns  
Elastic and inelastic buckling theories, effect of residual stress and initial curvature, local buckling
7. Beams  
Review of local buckling, plastic action and moment redistribution, lateral buckling, inelastic effects
8. Beam-Columns  
In-plane behaviour, behaviour in the inelastic range, ultimate strength and stability, interaction equations, twist buckling, local buckling
9. Connections  
High-strength bolts and welds, installation, behaviour and inspection, axially loaded connections, eccentrically loaded connections, moment connections
10. Other topics if time permitted

**Marking:**

Assignments: 40%

Final Exam: 60%

1. The instructor may modify the outline during the term as the course progresses.
2. Final examination is for evaluation purposes only and will not be returned to the student.
3. **Academic Accommodation**  
You may need special arrangements to meet your academic obligations during the term. For an accommodation request, the processes are as follows:

#### **Pregnancy obligation**

Requests for parental leave must be made in writing to the Registrar's Office, or in the case of graduate students, to the Office of the Dean of Graduate and Postdoctoral Affairs.

A student who is pregnant may request a temporary modification to her program (e.g., laboratory or field work). The student should meet with the instructor(s). The department chair/director and the faculty dean can assist in the discussion. An Equity Services advisor can also be consulted if a student has questions about pregnancy and/or parental leave. For more details, visit the Equity Services website: [students.carleton.ca/course-outline](https://students.carleton.ca/course-outline)

#### **Religious obligation**

A request should be made in the first two weeks of the academic term, or as soon as possible where the scheduling of an event or activity conflicting with a religious obligation does not appear in the course outline or calendar.

A list of multi-faith holy days is accessible through the Equity Services website. Instructors can also contact Equity Services to confirm the eligibility of a religious event or practice. For more details, visit the Equity Services website: [students.carleton.ca/course-outline](https://students.carleton.ca/course-outline)

#### **Academic Accommodations for Students with Disabilities**

"The [Paul Menton Centre for Students with Disabilities \(PMC\)](#) provides academic accommodations and support services to students with Learning Disabilities (LD), mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision.

If you have a permanent, persistent/prolonged, or temporary disability requiring academic accommodations in my course, please contact the PMC at 613-520-6608 or [pmc@carleton.ca](mailto:pmc@carleton.ca) for a formal evaluation.

If you are already registered with the PMC, please request your accommodations for this course through the [Ventus Student Portal](#) at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). Requests made within two weeks will be reviewed on a case-by-case basis. For final exams, the deadlines to request accommodations are published in the [University's Academic Calendars](#). After requesting accommodations through the Ventus Student Portal, please meet with me to discuss your accommodation needs and how they will be implemented in my course." For more details, visit the Equity Services website: [students.carleton.ca/course-outline](https://students.carleton.ca/course-outline)

#### **Survivors of Sexual Violence**

As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: [carleton.ca/sexual-violence-support](https://carleton.ca/sexual-violence-support)

#### **Accommodation for Student Activities**

Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. [students.carleton.ca/course-outline](https://students.carleton.ca/course-outline)

4. It is important to remember that COVID is still present in Ottawa. The situation can change at any time and the risks of new variants and outbreaks are very real. There are [a](#)

[number of actions you can take](#) to lower your risk and the risk you pose to those around you including being vaccinated, wearing a mask, staying home when you're sick, washing your hands and maintaining proper respiratory and cough etiquette.

**Feeling sick?** Remaining vigilant and not attending work or school when sick or with symptoms is critically important. If you feel ill or exhibit COVID-19 symptoms do not come to class or campus. If you feel ill or exhibit symptoms while on campus or in class, please leave campus immediately. In all situations, you must follow Carleton's [symptom reporting protocols](#).

**Masks:** Carleton has paused the [COVID-19 Mask Policy](#), but continues to strongly recommend masking when indoors, particularly if physical distancing cannot be maintained. It may become necessary to quickly reinstate the mask requirement if pandemic circumstances were to change.

**Vaccines:** Further, while proof of vaccination is no longer required as of May 1 to attend campus or in-person activity, it may become necessary for the University to bring back proof of vaccination requirements on short notice if the situation and public health advice changes. Students are strongly encouraged to get a full course of vaccination, including booster doses as soon as they are eligible, and submit their booster dose information in [cuScreen](#) as soon as possible. Please note that Carleton cannot guarantee that it will be able to offer virtual or hybrid learning options for those who are unable to attend the campus.

All members of the Carleton community are required to follow requirements and guidelines regarding health and safety which may change from time to time. For the most recent information about Carleton's COVID-19 response and health and safety requirements please see the [University's COVID-19 website](#) and review the [Frequently Asked Questions \(FAQs\)](#). Should you have additional questions after reviewing, please contact [covidinfo@carleton.ca](mailto:covidinfo@carleton.ca).

5. Student or professor materials created for this course (including presentations and posted notes, labs, case studies, assignments and exams) remain the intellectual property of the author(s). They are intended for personal use and may not be reproduced or redistributed without prior written consent of the author(s).
6. You may discuss with others, but you are required to submit your own work for Homework. You may not complete the submitted work collaboratively. See the institutional policy on the academic integrity (<https://carleton.ca/registrar/academic-integrity/>)
7. Students who claim illness, injury or other extraordinary circumstances beyond their control as a reason for missed term work / examination are held responsible for immediately informing the instructor concerned and for making alternate arrangements with the instructor and in all cases this must occur no later than three (3.0) working days after the term work was due.

**Textbooks:**

1. Kulak and Grondin, (2021). *Limit States Design in Structural Steel*. 11<sup>th</sup> Edition, Canadian Institute of Steel Construction, Toronto.
2. CISC, (2021). *Handbook of Steel Construction*. 12<sup>th</sup> Edition, Canadian Institute of Steel Construction. *Handbook of Steel Construction* can be obtained with student discounts. See details in course website.

**Some References:**

1. Gaylord, Gaylord and Stallmeyer, (1992). *Steel Structures*. 3<sup>rd</sup> Edition, McGraw-Hill, New York.
2. Salmon and Johnson, (1996). *Steel Structures: Design and Behaviour*. 4<sup>th</sup> Edition, HarperCollins College Publishers, New York.
3. Salmon, Johnson and Malhas, (2009). *Steel Structures: Design and Behaviour*. 5<sup>th</sup> Edition, Prentice Hall
4. Galambos, T.V., editor (1998). *Guide to Stability Design Criteria for Metal Structures*. 5<sup>th</sup> Edition, John Wiley & Sons, New York.
5. Oden, J.T. and Ripperger, E.A. (1980). *Mechanics of Elastic Structures*. 2<sup>nd</sup> Edition, McGraw-Hill
6. Ziemian, R.D. (2010). *Guide to Stability Design Criteria for Metal Structures*. 6<sup>th</sup> Edition, John Wiley & Sons, Inc., Hoboken, New Jersey.
7. Galambos, T.V. (1968). *Structural Members and Frames*. Prentice Hall, Eaglewood Cliffs.
8. Chen, W.F. and Lui, E.M., (1991). *Stability Design of Steel Frames*. CRC Press, Boca Raton.
9. Bleich, F. (1952). *Buckling Strength of Metal Structures*. McGraw-Hill, New York.
10. CISC (2019). *Moment Connections for Seismic Applications*. 3<sup>rd</sup> Edition, Canadian Institute of Steel Construction
11. Metten, A. and Driver, R. (2016). *Structural Steel for Canadian Buildings: A Designer's Guide*. 3<sup>rd</sup> Edition. Structured Solutions Inc.