Carleton University
Department of Civil and Environmental Engineering
Course Title:
BUILDING FIRE SAFETY – CIVE 4614
Course Syllabus – Winter 2024

## COURSE DESCRIPTION AND OBJECTIVES

This course introduces students to basic concepts related to fire safety in buildings and the response of structures when exposed to fires. It covers the basics of fire development and smoke production and movement, compartment fire behaviour, pre-flashover and post-flashover fires, burning characteristics of building materials and furniture and the effect of fire retardants. The course will also introduce students to simple correlations and computer models used to predict compartment fire dynamics. Also discuss laboratory-scale fire experiments, standard fire tests used to evaluate building materials and building elements and the use of the performance-based approach for building fire safety design and the economic aspects of fire.
**Prerequisites:** Fourth-year status in Engineering. All other students interested in taking the course will need permission of the Department.

## TOPICS (Tentative)

**Fire Safety in Buildings**
Overview; Fire Safety Objectives; Process of Fire Development; Conceptual Framework for Fire Safety; Fire Resistance; Controlling Fire Spread; Building Construction for Fire Safety
**Fire and Heat**
Overview; Fuels; Combustion; Fire Initiation; Burning Objects; t-squared Fires; Pre-flashover Design Fires; Heat Transfer
**Room Fires**
Overview; Pre-flashover fires; Flashover; Post-flashover Fires; Design Fires; Other Factors
**Fire Severity**
Overview; Fire Severity and Fire Resistance; Fire Severity; Standard Fire; Equivalent Fire Severity
**Fire Resistance**
Overview; Fire Resistance; Assessing Fire Resistance; Fire-resistance Tests; Approved Fire-resistance Ratings; Fire Resistance by Calculation; Fire Resistance of Assemblies
**Design of Structures Exposed to Fire**
Overview; Structural Design at Normal Temperatures; Structural Design in Fire Conditions; Material Properties in Fire; Design of Individual Members Exposed to Fire; Design of Structural Assemblies Exposed to Fire
**Steel Structures**
Overview; Behaviour of Steel Structures in Fire; Fire-resistance Ratings; Steel Temperatures; Protection Systems; Mechanical Properties of Steel at Elevated Temperature; Design of Steel Members Exposed to Fire; Design of Steel Buildings Exposed to Fire
**Concrete Structures**
Overview; Behaviour of Concrete Structures in Fire; Fire-resistance Ratings; Concrete and Reinforcing Temperatures; Mechanical Properties of Concrete at Elevated Temperatures; Design of Concrete Members Exposed to Fire; Composite Steel-Concrete Construction Exposed to Fire
**Timber Structures**
Overview; Description of Timber Construction; Fire-resistance Ratings; Wood Temperatures; Mechanical Properties of Wood; Design Concepts for Heavy Timber Exposed to Fire; Design of Heavy Timber Members Exposed to Fire; Behaviour of Timber Connections in Fire

## COURSE INSTRUCTOR

Professor Ehab Zalok, Ph.D., P.Eng. | Office: ME 2486 | Phone: +1 (613) 520-2600 x 7450
Office Hours: By appointment
ehab.zalok@carleton.ca (use Brightspace discussion section, email ONLY for non-course material's related questions)

## COURSE DELIVERY

- Lectures: Three hours a week
- Problem analysis: 1 ½ hours a week
- Office hours consultation: Instructor & TAs: arrange meeting time by email.
- Grading Details:
  - Midterm (50%): Feb 14th, 2023 (8:30 am – 11:30 am) | Closed book
  - Final Examination (50%) | Closed book
  - Students who score less than 33% during the term (term work) will be assigned the grade F, and,
  - A minimum percentage of 33% in the final exam is required to pass the course, and,
  - A minimum of 50% of term work plus final exam is required to pass the course.
  - The final examination is for evaluation purposes only, and the paper will not be returned or made available to students after it is marked.

## COURSE WEBSITE AND COMMUNICATION

Course information will be available through Brightspace. Students are responsible for ensuring that they are correctly registered and that they are receiving messages properly through their official university email account.

## SUGGESTED TEXTBOOK

- Buchanan, A.H., "Structural Design for Fire Safety" ISBN-10: 0470972890 ISBN-13: 978-0470972892 (Available in the bookstore)

## ACADEMIC INTEGRITY AND PLAGIARISM

a) Please consult the Faculty of Engineering and Design information page about the Academic Integrity policy and our procedures: https://carleton.ca/engineering-design/current-students/fed-academic-integrity Violations of the Academic Integrity Policy will result in the assignment of a penalty such as reduced grades, the assignment of an F in a course, a suspension or, expulsion.

b) One of the main objectives of the Academic Integrity Policy is to ensure that **the work you submit is your own.** As a result, it is important to write your own solutions when studying and preparing with other students and to avoid plagiarism in your submissions. The University Academic Integrity Policy defines plagiarism as "presenting, whether intentionally or not, the ideas, expression of ideas or work of others as one's own." This includes reproducing or paraphrasing portions of someone else's published or unpublished material, regardless of the source, and presenting these as one's own without proper citation or reference to the original source.

Examples of violations of the policy include, but are not limited to:

· any submission prepared in whole or in part, by someone else;
· using another's data or research findings without appropriate acknowledgement;
· submitting a computer program developed in whole or in part by someone else, with or without modifications, as one's own; and
· failing to acknowledge sources of information through the use of proper citations when using another's work and/or failing to use quotations marks.

## COPYRIGHT

## LEARNING AND WORKING ENVIRONMENT

The University and all members of the University community share responsibility for ensuring that the University's educational, work and living environments are free from discrimination and harassment. Should you have concerns about harassment or discrimination relating to your age, ancestry, citizenship, colour, creed (religion), disability, ethnic origin, family status, gender expression, gender identity, marital status, place of origin, race, sex (including pregnancy), or sexual orientation, please contact the Department of Equity and Inclusive Communities at equity@carleton.ca

We will strive to create an environment of mutual respect for all through equity, diversity, and inclusion within this course. The space which we work in will be safe for everyone. Please be considerate of everyone's personal beliefs, choices, and opinions.

## ACADEMIC ACCOMMODATIONS

You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

**Academic Accommodations for Students with Disabilities**: The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/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 disability requiring academic accommodations in this course, please contact PMC at **613-520-6608** or pmc@carleton.ca .

You should request your academic accommodations in the Ventus Student Portal, for each course at the beginning of every term. For in-term tests or midterms, please request accommodations at least two (2) weeks before the first test or midterm. Please consult the PMC website for the deadline to request accommodations for the formally-scheduled exam (if applicable).

**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. For more details, see the Senate Policy on Accommodation for Student Activities (PDF).

**Pregnancy Obligation**: 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. For more details, please review the Student Guide to Academic Accommodation (PDF).

**Religious Obligation**: 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. For more details, please review the Student Guide to Academic Accommodation (PDF).

**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 where 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 the Sexual Violence Prevention & Survivor Support.

## ENGINEERING ACADEMIC ADVISING

The Engineering Academic Support Service assists undergraduate engineering students with course selection, registration, and learning support from first-year through to graduation.

Academic Advisors Contact can be found here: https://carleton.ca/engineering-design/current-students/undergrad-academic-support/undergraduate-advisors/.

## STUDENT MENTAL HEALTH AND WELLNESS

As a university student you may experience a range of mental health challenges that can significantly impact your academic success and overall well-being. Carleton's Wellness Services Navigator is designed to help students connect with mental health and wellness resources.
If you need to talk to someone from the department for more information and support with connecting to resources, you can contact the following faculty members, depending on your program. Or contact the department at orCEEUGChair@cunet.carleton.ca.

**ACSE**: Prof. Scott Bucking
Email: scott.bucking@carleton.ca, Office: 5209 Canal Building
**CIVE**: Prof. Heng Khoo
Email: heng.khoo@carleton.ca, Office: 3364 Mackenzie
**ENVE**: Prof. Shoeleh Shams
Email: shoeleh.shams@Carleton.ca, Office: 4242 Mackenzie

*Modified: January 6, 2024*