

CARLETON UNIVERSITY
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
CIVE 5614 - DESIGN FOR FIRE RESISTANCE
COURSE OUTLINE-2018 Fall

COURSE OBJECTIVES: Building codes set fire-resistance requirements for building assemblies to curtail both the spread of fire within buildings and the collapse of structural elements exposed to fire. Although the traditional method for assessing the fire resistance of building assemblies is by means of standard fire tests, recent years have witnessed the increasing use of mathematical modelling techniques.

This course is intended to provide the engineer with the basic knowledge required to design buildings for fire resistance. The student will be able to develop an understanding of the fire severity concept, to estimate time-temperature relationships for flashover fires, to perform the design of steel, concrete and wood building assemblies to resist fire exposure. As part of the structural fire design, material properties at elevated temperatures will also be discussed.

PREREQUISITE: Bachelor degree in Civil or Mechanical Engineering

INSTRUCTOR: Professor Ehab Zalok, Ph.D., P.Eng.

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COURSE TOPICS:

Fire Safety in Buildings - Fire and Heat

Overview; Fire Safety Objectives; Process of Fire Development; Conceptual Framework for Fire Safety; Fire Resistance; Controlling Fire Spread; Building Construction for Fire Safety; 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

Light Frame Construction (may be)

Overview; Description; Fire Behaviours; Fire-resistance Ratings; Properties of Gypsum Plaster Board; Temperatures Within Light Frame Assemblies; Structural Behaviour; Design of Light Frame Structures in Fire; Construction Details; Lightweight Sandwich Panels

COURSE FORMAT:

- Lectures: Three hours a week
- Office hours consultation
- Grading/tentative dates:
 - Midterm (40%) Oct 30th, 2018
 - Final Exam (60%)

RECOMMENDED REFERENCES:

- Buchanan, A.H., "Structural Design for Fire Safety" ISBN-10: 0470972890 ISBN-13: 978-0470972892
- T.T. Lie, (Editor), Structural Fire Protection, American Society of Civil Engineers, Manuals and Reports on Engineering Practice No. 78, 1992.
- The SFPE Handbook of Fire Protection Engineering, 4th Edition, National Fire Protection Association, Quincy, MA, 2008.

NOTE TO JOB SEEKERS AND GRADUATE STUDENTS

I can serve as a reference for you in your job search. The requirement for getting a reference letter is to achieve an 'A+' in the course. Letters of reference will be sent directly to employers or under signed seal to you.

COURSE OUTLINE (SYLLABUS) INFORMATION ON ACADEMIC ACCOMMODATIONS

Requests for 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

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, visit the Equity Services website: carleton.ca/equity/wp-content/uploads/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, visit the Equity Services website: carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf

Academic Accommodations for Students with Disabilities

If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made. carleton.ca/pmc

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 is 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

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. <https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf>

For more information on academic accommodation, please contact the departmental administrator or visit: students.carleton.ca/course-outline

Modified: September 10, 2018