CARLETON UNIVERSITY
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
CIVE 5614 - DESIGN FOR FIRE RESISTANCE
COURSE OUTLINE - 2022 Winter

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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Office Hours: Online, by appointment

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 DELIVERY:

Asynchronous course - an online course where the instructor and students share information, ideas, and learning experiences in a virtual course space. While there is a scheduled time associated with the course for registration, students can move through course material on their own schedule. Lecture videos will be posted weekly before the scheduled lecture time. Videos could be segmented for ease of viewing, to make it easy to refer to them, and take notes. Industry professionals may deliver lectures on related topics. Contents from the guest lectures are included in assignments and the final exam.

- Lectures: Three hours a week
- Grading & Details:
  - Midterm (40%): Date/Time: TBA. Format: e-proctoring
  - Final Examination (60%)
  - 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.
  - Tests and examinations in this course will use a remote proctoring service provided by Scheduling and Examination Services. You can find more information at https://carleton.ca/ses/e-proctoring/.

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 address.

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, 5th Edition, National Fire Protection Association, Quincy, MA, 2016. ISBN: 978-1-4939-2564-3

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 undersigned seal to you.

COURSE POLICIES

Appeals

All appeals for marks assigned in this course must be made within 7 days of the posting date.

Academic Integrity

Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensure that a degree from Carleton University is a strong signal of each student's individual academic achievement. As a result, the University treats cases of cheating and plagiarism very seriously. Carleton University's Policy on Academic Integrity (http://www.carleton.ca/studentaffairs/academic-integrity) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences. It is your responsibility to be familiar with these policies. Any students who do not act with academic integrity will face severe consequences including immediate referral to Associate Dean of Student Affairs.

Email Policy

Emails must come from official Carleton University email addresses or through Brightspace. Problem analysis questions: Direct those to the Teaching Assistants.

Extensions and Rewrites

In the interest of fairness for all students, requests for rewrites will only be granted for situations that are truly out of a student's control.

Academic Accommodation

Students with diverse learning styles and needs are welcome in this course. You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

Pregnancy obligation: write to me 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: http://www2.carleton.ca/equity/

Religious obligation: write to me 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: http://www2.carleton.ca/equity/

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 for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation 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. After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website (www.carleton.ca/pmc) for the deadline to request accommodations for the formally-scheduled exam (if applicable).

You can visit the Equity Services website to view the policies and to obtain more detailed information on academic accommodation at http://www2.carleton.ca/equity/

Modified: January 10, 2022