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

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 (ehab.zalok@carleton.ca - office: 3370 ME - Phone: +1 (613) 520-2600 ext. 7450)

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:
  o Group Project (30 %): Release date: Sep 27, Due date: Nov 22
  o Assignment #1 (10 %): Release date: Sep 27, Due date: Oct 25
  o Assignment #2 (10 %): Release date: Oct 25, Due date: Nov 15
  o Final Exam (50 %): Dec 6

RECOMMENDED REFERENCES:
• Andrew H. Buchanan, Structural Design for Fire Safety, John Wiley & Sons, 2001
• T.T. Lie, (Editor), Structural Fire Protection, American Society of Civil Engineers, Manuals and Reports on Engineering Practice No. 78, 1992.

ACADEMIC ACCOMMODATION:
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).

INSTRUCTIONAL OFFENCES:
Please consult the university undergraduate calendar for definitions and penalties.

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.

Modified: September 8, 2016