CARLETON UNIVERSITY
DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING
INTRODUCTION TO PRACTICAL APPLICATIONS OF FIRE PROTECTION

CIVE5617 – COURSE OUTLINE FALL 2021

CIVE5617 introduces students to the practical application of fire protection. It covers the practical use of Part 3 of the National Building Code of Canada (NBCC), National Fire Code of Canada (NFCC), and NFPA and ULC Standards with real-life problems from a consulting and a regulatory point of view. The course will also introduce basic concepts related to the design of fire protection systems (such as sprinklers, fire pumps, fire alarms, etc.), in addition to introducing to the differences between prescriptive and performance-based design and the use of computer modeling (CFAST, FDS, PyroSim, etc.). The course will also highlight gaps within the industry and assist students in developing a fire protection skillset which facilitates their transition from university to the work environment.

PREREQUISITES: Bachelor Degree in one of the following: Engineering, Science, Architecture Studies, Industrial Design

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COURSE FORMAT:
Lecture Time: Tuesday, 6:00 – 9:00 pm
Lecture Room: Online

Grading: Two Long Assignments (10%)
Group Project – Report (25%) & Presentation (25%)
Final Examination (40%)

References: National Building Code of Canada 2015
National Fire Code of Canada 2015
SFPE Handbook, 5th Edition
Buchanan, A.H., Fire Engineering Design Guide

TOPICS

Week 1: Course Introduction

- Description of the course intent, and the main items that students will obtain from this course;
- Outline what is expected of each student in order to excel in fire protection engineering;
- Summarizing the various streams that students can consider working in e.g. Forensics, Nuclear, Oil and Gas, Research, etc.

Week 2: Codes and Standards – Part I

- Describe the role and responsibilities of Authorities Having Jurisdiction (e.g. City of Ottawa, Canadian Nuclear Safety Commission, etc.);
- Provide a brief description on the history of prescriptive codes (e.g. NBCC and NFCC);
- Provide a general description of the intent of Part 3 of the NBCC, and deliver several practical examples on how the NBCC is used within the industry.

Week 3: Codes and Standards – Part II

- Provide a general description of the various parts of the NBCC, and deliver several practical examples on how the NBCC is used within the industry;
- Introduction to NFPA Standards (NFPA 13, 14, 25, etc.) and how these standards compliment the prescriptive national codes. Provide students with an overview of fire protection systems used in the industry and describe how NFPA standards are given authority via the national codes;
- Discuss with students how committees were formed and how codes and standards are kept up-to-date with ongoing research and lessons learnt from industry.

Week 4 to 6: Performance-Based Design

- Explain the definition of performance-based design (PBD) and alternative solutions;
- Describe the process required for requesting a performance-based design approval from the Authority Having Jurisdiction;
- Provide a couple case studies in which PBD were used to achieve the intent of the NBCC.

Week 7: Design of Fire Protection Systems

- Provide the history of how sprinklers were developed, and illustrate the various advancements of sprinkler design;
- Sprinkler design using the building, fire code, and NFPA 13 standards, and an in-depth discussion of several chapters of NFPA 13, such as Installation Requirements, General Requirements for Storage, System Inspection, Testing, and Maintenance, etc.;
- Real-life design examples of sprinkler design on high-rise buildings and industrial facilities.
- Fire alarm using the building, fire code, and Installation of Fire Alarm Systems Standard (ULC-S524-06), and how they apply to certain occupancies, and a discussion on the installation, verification, and inspection;
- Practical example on fire alarm design;
- Reviewing unique fire protection systems that have been designed;
- Describe the training required to produce such designs;
- Highlight key examples of the misuse/incorrect design of fire protection systems;
- Understanding the intent of fire protection systems and how systems can compliment each other in a building.

Week 8: Group Project Meetings

- The intent of this week is to review each group's progress with the project;
- Provide feedback on project to help align the work with the instructor's expectations;
- 15-minute meetings to be scheduled.

Week 9: Computer Modeling – Part I

- Provide a brief introduction of computer modelling, and list the various software available in the market;
- Clarify why certain software are used more than others;
- Introduce Two-Zone Modelling and summarize when its use is considered applicable via practical examples from case studies;
- Introduce Computational Fluid Dynamics Modelling and summarize when its use is considered applicable via practical examples from case studies;
- Discuss common errors and difficulties faced when using computer models;
- Highlight limitations of modelling;
- Verification and validation of modelling based on best practices and NUREG documents;
- In-class worked example based on a case study.

Week 10: Firefighitng & Fire Investigation

- How does fire protection engineering help firefighting?
- Discuss various methods used in fire investigation;
- Highlight how theoretical fire dynamics is applied when conducting fire investigation;
- Provide students with case studies.

Week 11: Presentations

- Students to present their PBD projects to the class;
- A jury of three professionals will grade the students.

Week 12: Final Exam

- Three-hour final exam;
- Students will be provided with paper copies of applicable NBCC/NFCC pages required to solve problem questions;
- Exam consists of multiple choice, short answer questions, and long answer questions;
- Exam is written not to test memory, however, to test the students' understanding of the course material

How This Course Will Compliment Existing Carleton Courses

The proposed course is intended to provide students with the practical application of fire protection over a 12-week period. The main intent is to compliment existing Fire Safety courses at Carleton University, where students can link theory to engineering practice.

CIVE 5612 (*Fire Modeling*) is intended to describe main modelling techniques used, in addition to providing insight on the mathematical models and numerical solutions associated with the various modelling software. The *Introduction to Practical Applications of Fire Protection* course provides a quick recap on the CIVE 5612 course, in addition to providing modelling limitations from a practical engineering perspective which helps students link the theoretical knowledge learnt in CIVE 5612 to how the industry performs modelling. The *Introduction to Practical Applications of Fire Protection* course will also provide students with guidance on how to verify and validate models, which would be based on practical experience and NUREG documentation. One of the highlights of this course is the ability of the instructors to provide students with case studies that demonstrate positives and negatives of the fire modelling software.

CIVE 5609 (*Fundamentals of Fire Protection Engineering)* is intended to provide students a description of building codes and standards, in addition to briefly discussing prescriptive and performance-based code. Given that PBD is a main portion of this course, it is recommended that students have some understanding of fire protection systems and as such the *Introduction to Practical Applications of Fire Protection* course builds on the foundations of CIVE 5609 and expands the discussion on these topics while also providing a brief recap for those students who have not taken CIVE 5609. The course will also entail a detailed discussion on the following topics:

- Roles and responsibilities of the Authorities Having Jurisdiction (e.g. City of Ottawa and the Canadian Nuclear Safety Commission);
- History of the prescriptive codes and how practical experience helped in the development of the codes;
- In-depth discussion regarding functional and objective statements of NBCC and how to achieve the intent of the code;
- PBD worked example that will require 3 weeks to complete with the students.

Student 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*). "