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

COURSE OUTLINE WINTER 2019

This course 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.

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

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COURSE FORMAT:
Lecture Time: Thursday, 6:00 – 9:00 pm
Lecture Room: TBD

Grading: Midterm (25%)
Group Project – Report (15%) & Presentation (10%)
Final Examination (50%)

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. In addition, outlining 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). Furthermore, 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
- 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: 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 5: 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 6: Midterm
Week 7: 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 8 to 10: Performance-Based Design Worked Example
- Deliver a 3-week PBD example that will walk the students through all stages of the PBD process.
  - Example to be developed in the upcoming weeks.

Week 11: Gaps in Industry
- Discuss the common gaps in the industry and how the next generation of fire protection engineers can help improve fire protection engineering.
- How to get involved with various organizations and committees to gain additional skills and knowledge.

Week 12: Final Exam

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.