American Public University System

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School of Public Service & Health
Fire Service
FSMT320
Fire Protection Structures and Systems Design
3 Credit Hours
8 Week Course
Prerequisite: None

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Instructor Information

Instructor:

Email:

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Course Description (Catalog)

This course examines design principles involved in structural fire protection and automatic suppression systems, including fire resistance and endurance, flame spread evaluation, smoke control, alarm systems, sprinkler innovations, evaluation of sprinkler system designs, and specialized suppression system.

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Course Scope

The purpose of this course is to build on what you have learned in building construction, fire behavior and in hydraulics in order to see the structure as a system. One of the biggest problems we face in fire and life safety is that most buildings grow over time and all too often include systems that are both dated and designed for another risk. It is the errors caused by design faults or old that put occupants at risk. It is the failure to see the structure as a system that causes loss of life and property. Advanced fire suppression systems must be properly designed and also the occupants must be properly trained to react in concert with the life safety systems and the fire department. In addition, the importance of a good relationship between the authority having jurisdiction and those charged with the enforcement of the code. It is also important to keep in mind that the more you know about how systems function and how they protect a space or process the easier it will be to interact with owners, engineers, architects and contractors to insure they know how important the design codes are to the life of the structure.

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Course Objectives

After successfully completing this course, you will be able to

CO-1: Evaluate the influence of the lessons of the past on present day fire protection systems.
CO-2: Compare and evaluate the systems approach to building fire protection.
CO-3: Evaluate the need for and determine the proper design objective for fire protection systems in specific situations and hazards.
CO-4: Identify and evaluate the various tests made to determine materials and structures needed for a building or hazard fire protection system.
CO-5: Identify and determine the specific use of heat, smoke and flame detection systems.
CO-6: Categorize the components and effects of smoke and fire gasses and evaluate their effects on life safety.
CO-7: Employ the factors that influence smoke movement and apply these to increase life safety in a structure.
CO-8: Identify and evaluate water supply systems to meet the needs of structural fire protection.
CO-9: Apply hydraulics formulae to the design and evaluation of various types of sprinkler systems.
CO-10: Interpret the role of the fire service and the authority having jurisdiction in the review of plans and inspection of facilities for fire code compliance.

CO-11: Compare and identify the various ways to calculate and design fixed water fire suppression systems.

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Course Delivery Method

This course delivered via distance learning will enable students to complete academic work in a flexible manner, completely online. Course materials and access to an online learning management system will be made available to each student. Online assignments are due by Sunday evening of the week as noted and include Forum questions (accomplished in groups through a threaded forum), examination, and individual assignments submitted for review by the Faculty Member). Assigned faculty will support the students throughout this eight-week course.

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Course Resources

Required Course Textbooks

The text for *Design of Special Hazard and Fire Alarm Systems, 2nd Edition* by Robert Gagnon will use an e-book as the primary delivery format for August 2012 & beyond. Overseas students will continue to receive a hard copy, but if they are still awaiting their text in the beginning of class they will likely find this option helpful as well.

Links to the e-book can be found in Sakai under “announcements” as well as under “resources.”

- Gagnon, R.M. (2008). *Design of Special Hazard and Fire Alarm Systems, (2nd Ed.). Clinton Park, NY:* Delmar Learning Thompson. ISBN 1-4180-3950-0
- *NFPA 550: Fire Safety Concepts Tree*. National Fire Protection Association. NFPA item number YA-5507.

Supplemental Materials: All of the reports listed in this first group are available on-line from the United States Fire Administration’s Technical Report Series at: https://www.usfa.dhs.gov/applications/publications/

- United States Fire Administration. *Fire at Watts Bar Hydroelectric Plant (Rhea County, TN - September 2002*. http://www.usfa.dhs.gov/downloads/pdf/publications/tr-147.pdf
- United States Fire Administration. *Comparison of Fire Sprinkler Piping Materials.* http://www.usfa.dhs.gov/downloads/pdf/publications/fa-150.pdf

- United States Fire Administration. *Review of Residential Sprinkler Systems: Research and Standards* http://www.usfa.dhs.gov/downloads/pdf/nistir6941.pdf
- National Institute of Standards and Technology. *Building and Fire Research Laboratory. Smoke Control.* http://fire.nist.gov/bfrlpubs/fire95/PDF/f95123.pdf
- National Institute of Standards and Technology. *Smoke Production and Properties.* http://fire.nist.gov/bfrlpubs/fire95/PDF/f95126.pdf
- National Institute of Standards and Technology. *Smoke Management Systems. Federal Building and Fire Safety Investigation of the World Trade Center Disaster.* http://fire.nist.gov/bfrlpubs/build05/PDF/b05039.pdf
- National Institute of Standards and Technology. *Toxic Hazard of Building Products and Furnishings.* http://fire.nist.gov/bfrlpubs/fire01/PDF/f01124.pdf
- National Institute of Standards and Technology. *Measurement Concerns and Opportunities for Commercial Fire Testing Laboratories.* http://fire.nist.gov/bfrlpubs/fire01/PDF/f01137.pdf
- National Institute of Standards and Technology. *Cook County Administration Building Fire, 69 West Washington, Chicago, Illinois, October 17, 2003: Heat Release Rate Experiments and FDS Simulations*. http://fire.nist.gov/bfrlpubs/fire04/PDF/f04050.pdf
- National Institute of Standards and Technology. *Quick Response Sprinklers in Chemical Laboratories: Fire Test Results.* http://fire.nist.gov/bfrlpubs/fire89/PDF/f89002.pdf
- National Institute of Standards and Technology. *Impact of Sprinklers on the Fire Hazard in Dormitories: Day Room Fire Experiments*. http://fire.nist.gov/bfrlpubs/fire04/PDF/f04012.pdf

Web Sites

In addition to the required course texts, the following public domain web sites are useful. Please abide by the university's academic honesty policy when using Internet sources as well. Note web site addresses are subject to change.

Site Name	Web Site URL/Address
Firefighting News	http://firefightingnews.com/united-states.cfm
Firehouse Magazine	http://www.firehouse.com
National Fire Protection Association	http://www.nfpa.org
National Fire Sprinkler Association	http://www.nfsa.org
National Institute of Occupational Safety and Health (NIOSH)	http://www.cdc.gov/niosh/homepage http://www.cdc.gov/niosh/firehome.html
National Institute of Standards and Technology	http://www.nist.gov http://www.brfl.nist.gov
United States Forest Service	http://www.fs.fed.us
United States Fire Administration	http://www.usfa.dhs.gov/ http://www.usfa.dhs./publications http://www.usfa.dhs.gov/publications/techreps.cfm

United States House of Representatives Office of the Law Revision Counsel, United States Code	http://uscode.house.gov/
United States National Records and Archives Administration, GPO - Code of Federal Reg.	http://www.gpoaccess.gov/cfr/index.html
Women in the Fire Service	http://www.wfsi.org/

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Evaluation Procedures

Readings:

The textbook and several additional readings will be covered throughout this eight week (8) course. As a student, you are expected to read each of the assigned readings and complete the corresponding assignment. Personal opinions not based or supported by the published literature are not acceptable - there are no wrong or right answers; there are just complete and incomplete answers.

Forum Assignments:

There are various required discussion Forum assignments. For most Forum assignments you are required to answer the posted questions and provide literature support where applicable. Each Forum assignment will require you to respond to at least two classmate postings in order to earn full credit for the Forum.

Essay Assignments:

Essay Assignments are designed to sharpen your writing skills and your research skills and as such, all writing assignments require providing additional research that supports your conclusions. All assignments should be well-written and formatted in APA Style (Sixth Edition). All assignments must have proper citations of any source(s) used and be accompanied by an APA References page.

Exams/Quizzes

Each week you will have a short quiz on the material for the week. The quizzes will consist of a mixture of multiple choice, fill-in-the blank, and short answer questions. The exams are open-book with no time limit, but you will only have one submission attempt.

You will also have a comprehensive Final Examination due in Week 8 exam consisting of multiple choice, fill-in-the blank, and short answer questions. The Final Exam is open-book with

no time limits, but there is only one attempt allowed. Please provide references to support your content where applicable.

Grade Instruments	% of Final Grade
Forums	**30**
Essays	**20**
Quizzes	**30**
Final Exam	**20**
Total	**100%**

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Course Outline

Please see the Student Handbook to reference the University's grading scale.

Week	Topic	Learning Objectives	Readings	Assignment
1	**Fundamental Concepts and Ethics**	**CO-1:** Evaluate the influence of the lessons of the past on present day fire protection systems. **CO-2:** Compare and evaluate the systems approach to building fire protection. **CO-10:** Interpret the role of the fire service and the authority having jurisdiction in the review of plans and inspection of	• Gagnon - Chapters 1 & 2 • *NFPA 550 – Guide to the Fire Safety Concepts Tree*, pages 550-4 – 550-14. This publication is the framework for our look at a "systems approach" to fire safety.	**Week 1 – Introduction Forum** **Week 1 - Quiz**

		facilities for fire code compliance.		
2	**Special Hazard Agents and Low Expansion Foam Systems**	**CO-2:** Compare and evaluate the systems approach to building fire protection. **CO-3:** Evaluate the need for and determine the proper design objective for fire protection systems in specific situations and hazards. **CO-4:** Identify and evaluate the various tests made to determine materials and structures needed for a building or hazard fire protection system.	• Gagnon - Chapters 3 & 4 • NIST - *Toxic Hazard of Building Products and Furnishings*.	**Week 2 – Forum** **Week 2 – Quiz**
3	**Medium and High Expansion Foam, Water Mist Systems**	**CO-9:** Apply hydraulics formulae to the design and evaluation of various types of sprinkler systems. **CO-11:** Compare and identify the various ways to calculate and	• Gagnon - Chapters 5 & 6 • NIST - *Cook County Administration Building Fire, 69 West Washington, Chicago, Illinois, October 17, 2003: Heat Release Rate Experiments and FDS Simulations.*	**Week 3 – Quiz** **Week 3 – Essay**

		design fixed water fire suppression systems.		
4	**Ultra High-Speed Systems, Clean Agent and Halon Systems**	**CO-9:** Apply hydraulics formulae to the design and evaluation of various types of sprinkler systems. **CO-11:** Compare and identify the various ways to calculate and design fixed water fire suppression systems	• Gagnon - Chapters 7 & 8 • NIST - *Smoke Production and Properties.* • NIST - *Smoke Management Systems. Federal Building and Fire Safety Investigation of the World Trade Center Disaster*.	**Week 4 – Forum** **Week 4 – Quiz**
5	**Carbon Dioxide, Dry and Wet Chemical Systems**	**CO-3:** Evaluate the need for and determine the proper design objective for fire protection systems in specific situations and hazards. **CO-7:** Employ the factors that influence smoke movement and apply these to increase life safety in a structure.	• Gagnon - Chapters 9 & 10 • USFA - *Fire at Watts Bar Hydroelectric Plant (Rhea County, TN - September 2002*.	**Week 5 – Quiz** **Week 5 – Essay**
6	**Fire Detection, Alarm and Initiating Devices**	**CO-5:** Identify and determine	• Gagnon - Chapters 11 & 12	**Week 6 - Forum**

	.	the specific use of heat, smoke and flame detection systems. **CO-6:** Categorize the components and effects of smoke and fire gasses and evaluate their effects on life safety. **CO-7:** Employ the factors that influence smoke movement and apply these to increase life safety in a structure.		**Week 6 - Quiz**
7	**Fire Alarm Notification and Detector Placement**	**CO-5:** Identify and determine the specific use of heat, smoke and flame detection systems. **CO-6:** Categorize the components and effects of smoke and fire gasses and evaluate their effects on life safety. **CO-7:** Employ the factors that influence smoke movement and apply these to	• Gagnon - Chapters 13 & 14 • USFA - *Comparison of Fire Sprinkler Piping Materials* • NIST - *Quick Response Sprinklers in Chemical Laboratories: Fire Test Results*.	**Week 7 – Forum** **Week 7 – Quiz**

		increase life safety in a structure.		
8	**Fire Alarm Circuit and Control Unit Design**	**CO-5:** Identify and determine the specific use of heat, smoke and flame detection systems.	• Gagnon - Chapter 15 • USFA - *Review of Residential Sprinkler Systems: Research and Standards*. • NIST - *Impact of Sprinklers on the Fire Hazard in Dormitories: Day Room Fire Experiments*.	**Week 8 - Forum** **Final Examination**

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Policies

Please see the Student Handbook to reference all University policies. Quick links to frequently asked question about policies are listed below.

Drop/Withdrawal Policy
Plagiarism Policy
Extension Process and Policy
Disability Accommodations

Writing Expectations
Describe your writing expectations.

Citation and Reference Style
Attention Please: Students will follow the APA Format as the sole citation and reference style used in written work submitted as part of coursework to the University. Assignments completed in a narrative essay or composition format must follow the citation style cited in the APA Format.

Late Assignments
Students are expected to submit classroom assignments by the posted due date and to complete the course according to the published class schedule. As adults, students, and working professionals, I understand you must manage competing demands on your time. Should you need additional time to complete an assignment, please contact me before the due

date so we can discuss the situation and determine an acceptable resolution. Routine submission of late assignments is unacceptable and may result in points deducted from your final course grade.

Netiquette

Online universities promote the advancement of knowledge through positive and constructive debate – both inside and outside the classroom. Forums on the Internet, however, can occasionally degenerate into needless insults and "flaming." Such activity and the loss of good manners are not acceptable in a university setting – basic academic rules of good behavior and proper "Netiquette" must persist. Remember that you are in a place for the rewards and excitement of learning which does not include descent to personal attacks or student attempts to stifle the Forum of others.

- **Technology Limitations:** While you should feel free to explore the full-range of creative composition in your formal papers, keep e-mail layouts simple. The Sakai classroom may not fully support MIME or HTML encoded messages, which means that bold face, italics, underlining, and a variety of color-coding or other visual effects will not translate in your e-mail messages.
- **Humor Note:** Despite the best of intentions, jokes and especially satire can easily get lost or taken seriously. If you feel the need for humor, you may wish to add "emoticons" to help alert your readers: ;-), :), ☺

Disclaimer Statement

Course content may vary from the outline to meet the needs of this particular group.

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Online Library

The Online Library is available to enrolled students and faculty from inside the electronic campus. This is your starting point for access to online books, subscription periodicals, and Web resources that are designed to support your classes and generally not available through search engines on the open Web. In addition, the Online Library provides access to special learning resources, which the University has contracted to assist with your studies. Questions can be directed to **librarian@apus.edu**.

- ***Charles Town Library and Inter Library Loan:*** The University maintains a special library with a limited number of supporting volumes, collection of our professors' publication, and services to search and borrow research books and articles from other libraries.
- ***Electronic Books:*** You can use the online library to uncover and download over 50,000 titles, which have been scanned and made available in electronic format.

- ***Electronic Journals:*** The University provides access to over 12,000 journals, which are available in electronic form and only through limited subscription services.
- ***Tutor.com***: AMU and APU Civilian & Coast Guard students are eligible for 10 free hours of tutoring provided by APUS. Tutor.com connects you with a professional tutor online 24/7 to provide help with assignments, studying, test prep, resume writing, and more. Tutor.com is tutoring the way it was meant to be. You get expert tutoring whenever you need help, and you work one-to-one with your tutor in your online classroom on your specific problem until it is done.

Request a Library Guide for your course (http://apus.libguides.com/index.php)
The AMU/APU Library Guides provide access to collections of trusted sites on the Open Web and licensed resources on the Deep Web. The following are specially tailored for academic research at APUS:

- Program Portals contain topical and methodological resources to help launch general research in the degree program. To locate, search by department name, or navigate by school.
- Course Lib-Guides narrow the focus to relevant resources for the corresponding course. To locate, search by class code (e.g., SOCI111), or class name.

If a guide you need is not available yet, please email the APUS Library: librarian@apus.edu.

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Turnitin.com

Turnitin.com is a web-based plagiarism prevention application licensed, for campus use, through the APUS Online Library. The quick submit option lets faculty upload and check suspicious papers, without requiring student to create their own Turnitin.com profiles.

Turnitin.com analyzes electronic submissions of student writing, compares them to the contents of a huge online database, and generates a customized Originality Report. The database used to produce this analysis contains a massive collection of documents available on the Internet from both free and commercial sources, as well as the full texts of all other papers that have been previously submitted to Turnitin.com.

Similarity index is based on the amount of matching text to a submitted paper:

Blue = no matching text
Green = one word to 24% matching
Yellow = 25 -49% matching text

Selected Bibliography

--------Automatic Sprinkler Systems Handbook. National Fire Protection Association. 2007

--------Automatic Sprinkler Standpipe Systems. National Fire Protection Association. 2006.

Brannigan, Francis. *Building Construction for the Fire Service*, Third Edition. National Fire Protection Association. 1992

Canter, David; Editor. *Fires and Human Behavior*, Second Edition. David Fulton Publishers, Ltd. London. 1990. ISBN 1-85346-105-9

Cote, Arthur E. *Fundamentals of Fire Protection*. National Fire Protection Association. 2004

Cote, Ron and Greg Harrison, *NFPA Life Safety Code Handbook*. National Fire Protection Association. 2006

--------Designer's Guide to Automatic Sprinkler Systems. National Fire Protection Association.. 2005

--------Facility Manager's Fie Protection Guide. National Fire Protection Association. 2006.

-------- *Fire Alarm Signaling Systems*. National Fire Protection Association.2007.

--------Fire Protection Engineering. National Fire Protection Association. 2002.

-------- *Fire Protection Handbook*, 14th Edition. National Fire Protection Association. 2003

-------- *Health Care Facilities Handbook*. National Fire Protection Association. 2005

Levy, Matthys and Mario Salvatdore. *Why Buildings Fall Down – How Structures Fail*. W. W. Norton. New York. 1994.

-------- *National Fire Alarm Code Handbook, NFPA 72*. National Fire Protection Association.2007.

--------Principles of Fire Protection. National Fire Protection Association. 1988

Salvadore, Mario. *Why Buildings Stand Up – The Strength of Architecture*. W. W. Norton. 2002. ISBN 0 -393-30676-3

Solomon, Robert E. Editor. *Fire and Life Safety Inspection Manual*. National Fire Protection Association. 2002

--------Uniform Fire Code Handbook. National Fire Protection Association. 2006

The following **codes and standards** developed and maintained by the National Fire Protection Association would be among those of value to the Fire Officer active in this field:

- NFPA 1 Uniform Fire Code
- NFPA 12 Carbon Dioxide Fire Systems
- NFPA 12A Halon 1301 Fire Extinguishing Systems
- NFPA 13 Installation of Sprinkler Systems
- NFPA 14 Installation of Standpipe and Hose Systems
- NFPA 15 Water Spray Fixed Systems for Fire Protection
- NFPA 16 Installation of Foam-Water Sprinkler and Foam-Water Spray Systems
- NFPA 17 Dry Chemical Extinguishing Systems
- NFPA 17A Wet Chemical Extinguishing Systems
- NFPA 18 Wetting Agents
- NFPA 20 Installation of Stationary Pumps for Fire Protection
- NFPA 99 Health Care Facilities
- NFPA 101 Life Safety Code

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