

Name:	<i>Fire Protection Structures and Systems Design</i>
Course Description:	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 systems.
Objectives:	<p>Unit 1: Fire Protection of the Building: An Introduction</p> <p>After completing this unit, you should be able to:</p> <ul style="list-style-type: none"> • explain the influence of historical fires on the evolution of building fire protection; • describe the origin and development of fire protection features; • list several lessons that can be learned from studying the development of fire protection; • compare the systems approach to other methods of decisionmaking; • list events that could define a fire scenario; • write a fire scenario; and • use the Fire Safety Concepts Tree to explain the relationship of fire protection features in buildings. <p>Unit 2: Fire Resistance and Fire Endurance</p> <p>After completing this unit, you should be able to:</p> <ul style="list-style-type: none"> • state the design objective for fire-resistant assemblies; • describe the interrelationships among fire load, fire severity, and fire endurance; • describe the ASTM E-119 Test, and the parameters that influence its validity; • describe the fire endurance tests for doors and windows; • state fire endurance test limitations that evolve from realistic design problems; • identify potential problems for fire service personnel relative to fire resistance requirements; and • approximate the fire resistance of composite assemblies, given the fire resistance ratings of the separate components. <p>Unit 3: The Computations and Evaluation Procedures for Fire Resistance</p> <p>After completing this unit, you should be able to:</p> <ul style="list-style-type: none"> • state the effect of elevated temperature on structural material properties; • describe the potential effect of a fire-induced change in material properties; • define the role of temperature in determining fire resistance; • describe the principles for calculating temperature distributions; • identify some important material properties that influence temperature distribution through the material; • describe several typical means of providing fire protection for steel members; • describe the basis of the calculation technique to determine fire resistance; • describe the principle by which water-filled columns provide fire resistance; and • state the advantages of flame shields that protect exposed steel.

Objectives:	Unit 4: Flame Spread Evaluation
	<p>After completing this unit, you should be able to:</p> <ul style="list-style-type: none"> • describe the Steiner tunnel test; • define Flame Spread Index; • describe the radiant panel test and its advantages; • compare the flame spread classification of interior finish materials located in corridors with fire propagation in corridors; • identify the role of flooring materials in corridor fire hazards; • describe the flooring radiant panel test and its advantages; and • explain why flame spread evaluation in the U.S. will be changing in the 1990s.
	<p>Unit 5: Smoke Production by Burning Materials</p> <p>After completing this unit, you should be able to:</p> <ul style="list-style-type: none"> • list and describe the components of smoke; • discuss the four categories of dangerous effects of smoke; • describe smoke toxicity testing methods; • interpret code requirements for smoke testing; and • discuss the limitations of our current knowledge and methods.
	<p>Unit 6: Furnishings and the Building</p> <p>After completing this unit, you should be able to:</p> <ul style="list-style-type: none"> • identify organizations that have promulgated standards for furniture flammability; • distinguish between the two types of furniture ignition; • explain the difference between component testing and mock-up testing of furniture; • explain the difference between bench-scale and full-scale testing of furniture; • state the dominant hazard of a fire involving furnishings; • identify factors other than the furniture characteristics that can influence fire growth in a room; • identify factors that can be used to estimate peak rate of heat release from burning furniture items; and • identify the major characteristics of furnishings used to evaluate fire safety.
	<p>Unit 7: Detection Systems and the Building</p> <p>After completing this unit, you should be able to:</p> <ul style="list-style-type: none"> • list the characteristics of smoke, heat, and flame detectors; • list the criteria for installing fire detectors; • state the recommended frequency of inspection of various types of detectors; and • describe maintenance requirements and procedures for the various detectors.

Objectives:	Unit 8: Smoke Control Systems
	<p>After completing this unit, you should be able to:</p> <ul style="list-style-type: none"> • list four factors influencing smoke movement; • describe the stack effect; • distinguish between passive and active smoke management; • describe the three basic types of smoke control systems; • evaluate design of a firefighter's smoke control station; and • approve a smoke control system testing procedure.
	Unit 9: Alarm and Communication Systems
	<p>After completing this unit, you should be able to:</p> <ul style="list-style-type: none"> • describe the principal types of fire alarm circuits; • describe the types of alarm signals used for fire alarm systems; • describe the purpose and functions of fire alarm signals; • note the operational characteristics of voice alarm systems; • describe the operational characteristics of fire alarm control panels; • describe the operational characteristics of computer-based fire alarm systems; and • list the principal functions of a building command center.
	Unit 10: Water Supply Systems
	<p>After completing this unit, you should be able to:</p> <ul style="list-style-type: none"> • trace the development of the public water supply system as a firefighting resource; • list and describe the essential elements of a public water supply system, including sources, distribution networks, piping, and hydrants; • assess the design characteristics of types of present-day hydrants; • note the benefits of developing a good working relationship between the fire department and the public water utility; • calculate the water supply needs for outside hose streams, standpipe, and sprinkler systems; and • state the special water supply needs of a high-rise building.
	Unit 11: Stationary Fire Pumps
	<p>After completing this unit, you should be able to:</p> <ul style="list-style-type: none"> • list and describe the characteristics, including the limitations, of the horizontal shaft fire pump; • list and describe the characteristics, including the limitations, of the vertical shaft fire pump; • describe a standard horizontal shaft pump installation; • describe a standard vertical shaft pump installation; • identify the auxiliary fittings required for a standard fire pump installation; • define the terms used in describing fire pump performance; • outline in sequential steps the proper procedure for conducting a service test on a selected stationary fire pump; and • plot the actual performance characteristics of a fire pump from a given set of field test data.

Objectives:	Unit 12: Sprinkler Innovations
	<p>After completing this unit, you should be able to:</p> <ul style="list-style-type: none"> • describe the unique challenges of quick response residential sprinkler systems; • list the "survivability criteria" for quick response residential sprinklers; • discuss the difference between the traditional <i>control</i> goal of sprinklers in an industrial environment and the new <i>suppression</i> goal of ESFR systems; and • explain why ESFR systems must be both early suppression and fast response.
	Unit 13: Hydraulic Calculations of Sprinkler Systems
	<p>After completing this unit, you should be able to:</p> <ul style="list-style-type: none"> • define the terms associated with sprinkler system hydraulic calculation methods; • compare and contrast the hydraulic characteristics of three current sprinkler system design concepts; • explain the dependent relationship between water supply and water demand curves; • state three basic formulas used in hydraulic calculations; • perform hydraulic calculations using the total pressure method; • identify a hydraulic calculation to balance flow in a looped system, according to the Hardy Cross method; and • identify a hydraulic calculation to balance flow by correcting pipe sizes in a looped system, according to the Newton-Raphson method.
	Unit 14: Evaluation of Sprinkler System Designs
	<p>After completing this unit, you should be able to:</p> <ul style="list-style-type: none"> • cite three of the principal reasons why buildings are sprinklered; • describe the role of the authority having jurisdiction in plan review; • check a sprinkler plan for completeness of information; • perform a sprinkler plan review using a standard methodology; and • describe the concepts of pipe schedule and hydraulic sprinkler system design methods.
	Unit 15: Specialized Suppression Systems
	<p>After completing this unit, you should be able to:</p> <ul style="list-style-type: none"> • describe how gaseous agent systems extinguish flames; • explain the operating principles of the three types of gaseous extinguishing systems; • describe how dry chemical agent extinguishing systems suppress flames; • explain the operating principles of dry chemical extinguishing systems; • list the types of foam extinguishing systems; • explain the operating principles of foam extinguishing systems; and • describe the inspection procedures for foam extinguishing systems.

Required Text:	<i>Fire Protection Structures and Systems Design Course Guide</i> , National Fire Academy	
Supporting References/ Research for Faculty and Students	<p>U. S. Fire Administration Publications: http://www.usfa.fema.gov/applications/publications/pubs_main.cfm See Fire Protection, Fire Administration, Fire Service Operations, Wildfire Applied Research: http://www.usfa.fema.gov/dhtml/inside-usfa/research.cfm Research Reports: http://www.usfa.fema.gov/dhtml/inside-usfa/r_reports.cfm Technical Reports: http://www.usfa.fema.gov/applications/publications/techreps.cfm Topical Fire Research Series: http://www.usfa.fema.gov/dhtml/inside-usfa/tfrs.cfm Learning Resource Center: http://www.usfa.fema.gov/dhtml/inside-usfa/lrc.cfm</p> <p>National Institute for Standards and Technology http://www.fire.nist.gov: Fire Tests/Data, Software/Models, Publications, FIREDOC (under Publications)</p> <p>References Society of Fire Protection Engineers: http://www.pentoncmg.com/sfpe/index.html</p> <p>Current Events/News http://www.firehouse.com/ http://www.fireengineering.com/ http://www.withthecommand.com/</p>	
Assessment:	Students will be evaluated for mastery of learning objectives by methods of evaluation to be determined by the instructor.	
NFPA Standards Addressed:	Unit(s)	Description
1021-4-5.1	7, 9, 10, 11, 15	Evaluate and identify alarm and suppression features
1031-3-3.5	10, 11, 13, 15	Determine the operational readiness of existed fixed systems
1031-3-3.6	7, 9	Determine the operational readiness of fire detection systems
1031-4-3.4	7, 9, 11, 15	Evaluate fire protection systems and equipment
1031-4-3.11	5, 6	Determine fire growth potential
Chief Fire Officer Designation Competencies Addressed:	www.cfainet.org This course provides partial fulfillment of CFOD: Competency #13 Public Education and Community Relations Competency #14 Training Competency #15 Fire Suppression	
Point of Contact:	Edward Kaplan, United States Fire Administration (301) 447-1127, ed.kaplan@fema.gov	

