Department of Education | College, Career and Technical Education

Fire Science I

Primary Career Cluster:	Law, Public Safety, Corrections, & Security
Consultant:	Candi Norwood, (615) 532-6248, Candi.Norwood@tn.gov
Course Code(s):	6152
Prerequisite(s):	*Principles of Fire and Emergency Services* (6154) and *Emergency Preparedness* (6151)
Credit:	1
Grade Level:	11-12
Graduation Requirements:	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Law, Public Safety, Corrections, & Security courses.
Programs of Study and Sequence:	This is the third course in the *Fire Management Services* program of study.
Aligned Student Organization(s):	SkillsUSA: http://www.tnskillsusa.org Tracy Whitehead, (615) 532-2804, Tracy.Whitehead@tn.gov
Coordinating Work-Based Learning:	Teachers are encouraged to use embedded WBL activities such as informational interviewing, job shadowing, and career mentoring. For information, visit https://tn.gov/education/topic/work-based-learning.
Available Student Industry Certifications:	Firefighter I
Dual Credit or Dual Enrollment Opportunities:	There are known dual credit/dual enrollment opportunities for this course. Reach out to a local postsecondary institution to establish an articulation agreement.
Teacher Endorsement(s):	751
Required Teacher Certifications/Training:	Tennessee Fire Commission Fire Fighter Instructor 1
Teacher Resources:	https://tn.gov/education/article/cte-cluster-law-public-safety

Course Description

Fire Science I is the third course in the *Fire Management Services* program of study. In this course, students will be prepared with technical knowledge and skills related to firefighter safety, fire behavior, building construction guidelines, and the use of firefighting equipment. Upon completion of this course, proficient students will be able to correctly demonstrate skills associated with ropes, ladders, and fire hoses in a non-live fire situation. Standards in this course are aligned with National Fire Academy Fire and Emergency Services (FESHE) model.

Program of Study Application

This is the third course in the *Fire Management Services* program of study. For more information on the benefits and requirements of implementing this program in full, please visit the Law, Public Safety, Corrections, & Security website at https://tn.gov/education/article/cte-cluster-law-public-safety.

Course Standards

Introduction to Fire Service Training

1) Perform the following skills of a basic level firefighter, as covered in the *Principles of Fire and Emergency Services* course, and articulate their importance:
    a. Levels of firefighters
    b. Organizational chart and chain of command of fire services
    c. National Incident Management System (NIMS) Incident Command System (ICS)-100 and NIMS ICS-700 skills (completed online)
    d. Use of Personal Protective Clothing and Equipment
    e. Self-Contained Breathing Apparatus (SCBA)
    f. Personal Alert Safety System (PASS)
    g. Scene Safety
    h. Emergency Communication, including mayday procedure
    i. Portable Fire Extinguisher use

    (FESHE PES 4, 6, 8)

Regulation (Firefighter Orientation)

2) When emergencies occur, fire, emergency medical services (EMS), and public safety personnel are required to follow standard operating procedures (SOPs) and/or "authorization to practice" guidelines. Define the terms SOP and authorization to practice, explain the various types of SOP, and relate why an SOP should follow the priorities of life safety, incident stabilization, and property conservation intention.

Based on the primary responsibilities of each department, develop an SOP for a fire department, an EMS department, and a public safety situation. Include code enforcement, public information, and public and private protection systems. (FESHE PES 10)

3) Summarize the importance, purposes, components, and elements of an incident command system (ICS). Include subdivisions within the ICS structure and explain the firefighter's role in a local incident command system. Capture those findings in a written, oral, or digital presentation, citing evidence from the investigation. (FESHE PES 7)

4) Examine the concepts and principles of the National Incident Management System (NIMS) that describe how emergencies are managed, from preparedness to recovery in a large region or when multiples agencies are involved. Successfully complete Federal Emergency Management Agency (FEMA) NIMS ICS-100 and NIMS ICS-700 training courses through the Emergency Management Institute.

5) During an emergency situation both private and public organizations and agencies can be involved. Identify these organizations or agencies; describe their functions, the kinds of careers available within each, the scope of their services, and jurisdiction issues that could arise. (FESHE PES 5)

6) Describe inspection practices and procedures. Understand code enforcement as it impacts life and property loss. (FESHE FP 5)

Incident Command Systems (Firefighter Orientation)

7) Construct an organizational chart of responding personnel on the scene of an incident. Describe the roles and responsibilities of each person then develop an Incident Action Plan (IAP) for a structural fire, a commercial fire, and a motor vehicle accident to which fire personnel are expected to respond. (FESHE PES 4, 6, 7)

   Outline the responsibilities of a local fire department when an emergency incident occurs according to NIMS. Discuss the importance of NIMS in such a situation and describe the requirements to deploy a NIMS-Incident Command System.

Fire Behavior

8) Analyze the basic components of fire as a chemical chain reaction, the major phases of fire, and examine the main factors that influence fire spread and fire behavior. (FESHE PES 2)

9) Identify the physical, chemical, and kinetic changes that occur in a fire. Develop a written, oral, and digital informational presentation summarizing these changes and supplemented by relevant explanations of matter, exothermic heat reaction, endothermic heat reaction, heat, measurements of temperature, and sources of heat energy.

10) Differentiate between the characteristics of a liquid fuel fire, a gas fuel fire, and a solid fuel fire. Include terminology specific to the science of fire in the explanation. Relate the types of fires in multiple structures such as inside structure, metal structure, or outside structure in an informative essay, citing information from textbooks or professional firefighter journals.

11) Summarize the stages of development of a fire in a compartment, examining the factors that can affect fire development. Differentiate between fire resistance, flame spread, and describe the testing procedures used to establish ratings for each. Explain in written format the multiple contributors to each stage, including specific terminology, possible preventive measures, and safety interventions. (FESHE Building Construction 6))

12) Explain the importance of understanding the concepts of thermal layering, rollover, flashover, isolated flames, hot-smoldering fire, and backdraft. Describe in a written, verbal, or graphic format the preventive measures and firefighter safety measures for each of these situations.

13) Firefighters can influence the behavior of a fire. Construct an explanation of the fire control theory, relating concepts of temperature reduction, fuel removal, oxygen exclusion, and chemical flame inhibition in a written or digital format.

Ventilation

1) Define the term ventilation as used in fire service; discuss reasons for fire-ground ventilation, principles of ventilation, considerations that affect the decision to ventilate, and challenges to ventilation in modern buildings. Review scenarios (including graphics) surrounding each and identify strategies to improve ventilation.

2) Explain theories surrounding vertical ventilation and the related safety precautions. Discuss warning signs of unsafe roof conditions, roof coverings, roof openings, and factors that reduce effectiveness when implementing vertical ventilation. Compare these findings to the same parameters associated with basement ventilation.

3) Compare and contrast the ventilation techniques associated with various types of roofs, including flat, pitched, arched, concrete, and metal roofs. Clarify the differences between a trench ventilation maneuver and a strip ventilation maneuver.

4) Infer from research the concepts surrounding horizontal ventilation, considerations for use, weather conditions that should be considered, internal and external exposures, and precautions against setting horizontal ventilation. Develop an informational essay sharing this information with other firefighter recruits.

5) Argue the advantages and disadvantages of forced and hydraulic ventilation using positive-pressure or negative-pressure ventilation in a building filled with flammable or toxic gas that must be ventilated quickly and safely.

Forcible Entry

6) Describe situations that would require forcible entry through a wood, metal, sliding, revolving, or overhead door; a window; a fire door; a gate; and a lock. Identify the tools that would be required for entry, and discuss the safety hazards and limitations of each tool. Perform the skills of cleaning, inspecting, and maintaining hand tools and equipment.

7) Outline the procedures, safety precautions, use of tools, and special considerations involved in the breaching of walls and floors when entry in a door or window is not possible. Perform the skills related to forcible entry with 100% accuracy as outlined by the following:
    a. Forced entry through an inward-swinging door – two-firefighter method
    b. Forced entry through an outward-swinging door - wedge-end method
    c. Forced entry using the through-the-lock method
    d. Forced entry using the through-the-lock method with the K-tool
    e. Forced entry using the through-the-lock method with the A-tool
    f. Forced entry through padlocks
    g. Forced entry through a double-hung window
    h. Forced entry through a glass pane window

Water Supply, Fire Hose, and Fire Streams

8) The use of water is an important factor in firefighting. Explain the components of water supply systems and how they can affect the success of putting out a fire, with emphasis on researching alternative, rural, and volunteer water supplies.

9) Compare and contrast the two types of fire hydrants, discussing the designs, purpose, operating principles, markings, locations, and testing procedures. Perform the skills of cleaning and inspecting fire hydrants and deploy a portable water tank.

10) Illustrate visually or graphically the primary aspects of fire hoses, including their construction, descriptions, sizes, and types of couplings. Perform the following Firefighter I skills:
    a. Make a straight hose roll
    b. Make a donut hose roll
    c. Couple a hose - foot-tilt method
    d. Couple a hose - two-firefighter method
    e. Uncouple a hose - knee-press method
    f. Uncouple a hose - two-firefighter method

11) Evaluate the NFPA 1961 *Standards on Fire Hose* concerning damage prevention, care for, and maintenance of a fire hose, as well as NFPA 1963 *Standard for Fire Hose Connections* for care of fire hose coupling. Inspect and clean a fire hose and its connections with 100% accuracy.

12) Attach one end of a fire hose to a source of water and the other to a sprinkler. While performing the process, identify and explain the functions of the most common hose appliances and tools, as well as the types of hose rolls.

13) Interpret concepts related to hose loads and finishes, preconnected hose loads, and supply hose lays. Perform the following skills related to these concepts:
    a. Make the accordion hose load
    b. Make the horseshoe hose load
    c. Make the flat hose load
    d. Make the preconnected flat hose load
    e. Make the triple layer hose load
    f. Make the minuteman hose load
    g. Connect to a hydrant using a forward lay
    h. Make the reverse hose lay

14) Describe procedures for and safety measures related to handling, advancing, and operating a hoseline in a visual, oral, or graphic presentation. Cite information from textbooks, professional journals, or the NFPA website in the explanation. Perform the following skills with 100% accuracy:
    a. Advance the preconnected flat hose load
    b. Advance the minuteman hose load
    c. Advance the triple layer hose load
    d. Advance hose - shoulder-load method
    e. Advance hose - working line drag method
    f. Advance a line into a structure
    g. Advance a line up and down an interior stairway
    h. Advance an uncharged line up a ladder into a window
    i. Extend a hoseline
    j. Replace a burst hoseline

15) Research the principles of fire streams and explain the physical and chemical effects, extinguishing properties, and characteristics of water on a fire.

16) Compare and contrast the types of fire stream patterns. Discuss advantages and disadvantages of each, examine the flow rate or pressure, determine if there is a need for water flow adjustment, observe pressure loss or gain, and demonstrate how to prevent a water hammer from occurring. Perform the following related skills:
    a. Operate a solid-stream nozzle
    b. Operate a fog stream nozzle - straight, narrow fog stream, and wide fog stream
    c. Operate a broken-stream nozzle

17) Distinguish between the solid-stream nozzle and the fog stream nozzle and the valves that are found in each. Develop a plan for care and maintenance of nozzles.

Standards Alignment Notes

*References to other standards include:

- National Fire Academy Fire and Emergency Services Higher Education (FESHE): Core Curriculum. This course aligns with outcomes of FESHE Principles of Emergency Services, Fire Prevention, and Building Construction for Fire Protection.
- P21: Partnership for 21st Century Skills Framework for 21st Century Learning

    - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.
- National Fire Protection Association (NFPA) Fire Fighter Professional Qualifications