Department of Education | College, Career and Technical Education

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Fire Science I

Primary Career Cluster:	Law, Public Safety, Corrections, & Security
Course Contact:	CTE.Standards@tn.gov
Course Code(s):	C30H06
Prerequisite(s):	*Principles of Fire and Emergency Services* (C30H04)
Credit:	1
Grade Level:	11-12
Focused Elective 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.
POS Concentrator:	This course satisfies one out of two required courses to meet the Perkins V concentrator definition, when taken in sequence in the approved program of study.
Programs of Study and Sequence:	This is the third course in the *Fire Management Services* program of study.
Aligned Student Organization(s):	SkillsUSA: http://tnskillsusa.com/
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://www.tn.gov/education/career-and-technical-education/work-based-learning.html
Available Student Industry Certifications:	Firefighter I
Teacher Endorsement(s):	751
Required Teacher Certifications/Training:	Tennessee Fire Commission Fire Fighter Instructor 1
Teacher Resources:	https://www.tn.gov/content/dam/tn/education/ccte/cte/cte_resource_law.pdf

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.

Approved April 10, 2015, Amended January 28, 2018

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://www.tn.gov/education/career-and-technical-education/career-clusters/cte-cluster-law-public-safety.html

Course Standards

Introduction to Fire Service Training

1) Articulate important historical events and milestones impacting the evolution of the current fire and emergency services systems in the United States. Discuss the growth of volunteer services and advances in equipment that have aided in the evolution. Use a timeline or other graphic to illustrate the major developments, citing specific textual evidence from research. (FESHE PES 1)

2) Identify the types, functions, and defining features of fire services and emergency medical service systems in the United States. Compare and contrast systems in urban, suburban, and rural communities. Include the types of personnel one would find in each locale, the mission upheld by each, and any differences in culture. Create a report and/or presentation on these comparisons. (FESHE PES 4, 6)

3) Research the common types of fire and emergency facilities, the types and functions of all apparatuses and vehicles used in fire and emergencies services. Develop a graphic illustration of each depicting all equipment and tools found with each type of vehicle. (FESHE PES 8)

Regulation (Firefighter Orientation)

4) When emergencies occur, fire, emergency medical services (EMS), and public safety personnel are required to follow standard operating procedures (SOPs) and "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)

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)

7) Develop a reference toolkit of physical, mental, and personal requirements for personnel in fire, emergency, and public safety services. Document what the "profile of proficiency" looks like for professionals in these fields—for example, what scores are needed on a physical,

mental, or emotional fitness test, and what guidelines must be followed for personal disease/disorder control. (FESHE PES 12)

Incident Command Systems (Firefighter Orientation)

8) 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)

9) 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.

10) Construct an organizational chart of responding personnel on the scene of an incident. Describe the roles and responsibilities of each person and 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)

11) 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.

12) Interpret scene management and safety standards and/or protocols by writing a scenario for each of the following situations: a) traffic or highway incidents, b) violent encounters, c) crowds, d) nature of illness or mechanisms of injury, e) number of patients and/or victims, and f) personnel accountability. Identify which control zones and additional resources would be involved. (FESHE PES 9)

Fire Behavior

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

14) Identify the physical, chemical, and kinetic changes that occur in a fire. Develop a multimedia 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.

15) 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.

16) 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 an infographic

the multiple contributors to each stage, including specific terminology, possible preventive measures, and safety interventions. (FESHE Building Construction 6)

17) 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.

18) 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 an electronic presentation.

Ventilation

19) 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 construct strategies to improve ventilation.

20) 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.

21) 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.

22) 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 peers.

23) 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

24) 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.

Water Supply, Fire Hose, and Fire Streams

25) 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.

26) 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.

27) 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.

28) 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

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

30) 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

31) 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, and create a document that explains the plan to a new employee.

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