FIRE 0073 - FIRE HYDRAULICS

Catalog Description

Hours: 54 lecture
Description: Investigate the principles and characteristics of water and water flow, water supply systems, fire apparatus and pumps, and fire streams. Review of applied mathematics; hydraulic laws; and application of formulas and mental calculation to hydraulics and water supply problems, as applied to the fire service. (CSU-with unit limitation)

Course Student Learning Outcomes

- CSLO #1: Analyze the extinguishing properties of water including the Law of Specific Heat and the Law of Latent Heat of Vaporization.
- CSLO #2: Define hydraulics and demonstrate the ability to formulate pump pressures.
- CSLO #3: Generate the correct engine pressure for various pumping situations.
- CSLO #4: Explain how to flow test a fire hydrant and calculate the available water.

Effective Term

Fall 2019

Course Type

Credit - Degree-applicable

Contact Hours

54

Outside of Class Hours

108

Total Student Learning Hours

162

Course Objectives

1. Analyze the extinguishing properties of water including the Law of Specific Heat and the Law of Latent Heat of Vaporization;
2. investigate the Five Principles of Pressure;
3. define hydrokinetics;
4. differentiate between Principles of Kinetic Energy, Principles of Pressure, and Principles of Friction;
5. investigate water supply systems;
6. compare various fire service apparatus and pumps;
7. define hydraulics and demonstrate the ability to formulate pump pressures;
8. compare the volume of water needed to extinguish a fire by estimating BTU's absorbed and steam generated;
9. compare and differentiate between force and pressure;
10. examine the basic principles of Bernoulli's theorem;
11. compare and contrast the Darcy-Weisbach Formula and the Hazen-Williams Formula;
12. differentiate between velocity and flow;
13. calculate water flow given area of discharge and velocity;
14. discuss the origins of the formula used to calculate gallons per minute of fire flow;
15. compare the four laws of hydraulics governing friction loss;
16. analyze the laws of physics that permit pumps to draft;
17. identify pump capacity limitations as discharge pressure increases;
18. investigate what properties are essential for an effective fire stream;
19. determine the correct engine pressure for various pumping situations;
20. calculate actual nozzle pressure, flow, and friction loss when hose lines are over pumped and under pumped;
21. evaluate sources of water for firefighting;
22. diagram a municipal water system;
23. flow test a fire hydrant and calculate the available water;
24. compare the concepts and principles of standpipe and sprinkler systems; and
25. evaluate a sprinkler system for proper performance.

General Education Information

- Approved College Associate Degree GE Applicability
- CSU GE Applicability (Recommended-requires CSU approval)
- Cal-GETC Applicability (Recommended - Requires External Approval)
- IGETC Applicability (Recommended-requires CSU/UC approval)

Articulation Information

- CSU Transferable

Methods of Evaluation

- Objective Examinations
  - Example: Students will take a multiple-choice test on the various types of hose lays. Standard Grading. Example Question: Which type of hose lay starts at the fire scene and is laid to the water supply? A. Forward, B. Reverse, C. Split lay, D. Open Lay.
- Problem Solving Examinations
  - Example: Students will calculate the available water supply and required fire flow for a 100,000 square foot warehouse. Grade based on industry standard.
- Reports
  - Example: In a report, students will explain the effect of elevation on the ability of a pump to obtain a vacuum and obtain a maximum lift. Rubric Grading.

Repeatable

No

Methods of Instruction

- Lecture/Discussion
- Distance Learning

Lecture:

1. The instructor will lecture on fire suppression sprinkler systems. The students will then be provided diagrams and schematics of a sprinkler system and will have to identify all components of the system. (Objective 24)
2. The instructor will lecture on the correct procedure of obtaining pressure readings for fire hydrant flow tests. The students will then perform field mathematical calculations to determine the water flow from various hydrants.

Distance Learning

1. Students will be required respond to weekly instructor questions and post responses. Students will also be required to respond to other student posts pertaining to the instructor questions. Example question: What is the difference between velocity and flow?

Typical Out of Class Assignments
Reading Assignments

1. The student will read the material in the textbook on Bernoulli's theorem and and be prepared to discuss in class how Bernoulli's equation and Torricelli's equation are inter-related. 2. The student will read the chapter on pump theory in the textbook and then complete the provided work sheet showing the water flow through a single stage pump and a dual stage pump in both the series and parallel setting.

Writing, Problem Solving or Performance

1. Prepare a list comparing and contrasting positive displacement pumps, rotary vane pumps, rotary lobe pumps, axial flow pumps, and radial flow pumps. 2. Weekly homework exercises utilizing specific formulas to solve various water flow problems.

Other (Term projects, research papers, portfolios, etc.)
Required Materials

- Fire Service Hydraulics and Water Supply
  - Author: Michael A. Wieder
  - Publisher: Fire Protection Publications
  - Publication Date: 2010
  - Text Edition: 2nd
  - Classic Textbook?:
  - OER Link:
  - OER:
- Fire Apparatus Driver/Operator
  - Author: International Association of Fire Chiefs and National Fire Protection Association
  - Publisher: Jones and Bartlett Learning
  - Publication Date: 2016
  - Text Edition: 2nd
  - Classic Textbook?:
  - OER Link:
  - OER:

Other materials and-or supplies required of students that contribute to the cost of the course.