

Las Positas College  
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### Course Outline for FST 53

### FIRE BEHAVIOR AND COMBUSTION

Effective: Fall 2018

#### I. CATALOG DESCRIPTION:

FST 53 — FIRE BEHAVIOR AND COMBUSTION — 3.00 units

Theory and fundamentals of why fires start, spread, and are controlled. An in-depth study of fire chemistry and fire physics, characteristics of materials, extinguishing agents, and fire control techniques.

3.00 Units Lecture

#### Grading Methods:

Letter Grade

#### Discipline:

- Fire Technology

	<b>MIN</b>
<b>Lecture Hours:</b>	54.00
<b>Expected Outside of Class Hours:</b>	108.00
<b>Total Hours:</b>	162.00

#### II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 1

#### III. PREREQUISITE AND/OR ADVISORY SKILLS:

#### IV. MEASURABLE OBJECTIVES:

**Upon completion of this course, the student should be able to:**

- Identify the fundamental theories of fire behavior and combustion
- Differentiate the various types of extinguishing agents, methods and techniques to the theory of fire extinguishment base on development of the flame plume
- Identify Physical properties of the three states of matter
- Categorize the components of fire
- Explain the physical and chemical properties of fire
- Describe and apply the process of burning
- Define and use basic terms and concepts associated with the chemistry and dynamics of fire
- Discuss various materials and their relationship to fires as a fuel
  - Explain the characteristics of water as a suppression agent
- Articulate other suppression agents and strategies
- Compare other methods and techniques of fire extinguishments
- Describe the basic laws differentiating matter and energy
- Explain basic terminology, definitions and terms associated with basic fire chemistry
- Identify some of the basic chemical symbols used in chemical formula writing
- Identify how physical forces caused by fire can affect the changes in the physical states of matter
- Identify the Department of Transportation warning placard and labeling system
- Describe the Department of Transportation Hazard Class System
- Compare and contrast flashover and backdraft in a compartmentalized fire

#### V. CONTENT:

- Introduction: Fire Chemistry and Physics
  - Matter and energy
  - The atom and its parts
  - Chemical symbols
  - Molecules
  - Energy and work
  - Forms of energy
  - Transformation of energy
  - Laws of energy
- Units of Measurement
  - International units of measurement
  - English units of measurement
- Chemical Reactions
  - Physical states of matter

2. Compounds and mixtures
3. Solutions and solvents
4. Process of reactions
- D. Fire and the Physical World
  1. Characteristics of fire
  2. Characteristics of solids
  3. Characteristics of liquids
  4. Characteristics of gases
- E. Heat and its Effects
  1. Production and measurement of heat
  2. Different kinds of heat
  3. Methods of heat transfer
  4. Sources of heat
- F. Properties of Solid Materials
  1. Common combustibles
  2. Plastics and polygons
  3. Combustible metals
  4. Combustible dusts
- G. Common Flammable Liquids and Gases
  1. Fire characteristics
  2. General properties of gases
  3. The gas laws
  4. Classification of gases
  5. Compressed gases
- H. Fire Behavior
  1. Structure and other physical barriers to fire
  2. Fire flow characteristics due to air movement
- I. Fire Extinguishment
  1. Types of suppression agents
- J. Extinguishing Agents
  1. Application of various suppression agents and their affects on fire
- K. Hazards by Classification Types (chemicals)
  1. Hazards of explosives
  2. Hazards of compressed gases
  3. Hazards of flammable liquids
  4. Hazards of flammable solids
  5. Hazards of oxidizing agents
  6. Hazards of poisons
  7. Hazards of radioactive substances
  8. Hazards of corrosives
- L. Burning rate
  1. Factors
  2. Formulas
  3. Heat
  4. Energy release signatures
- M. Fire Plumes
  1. Calculate flame height
  2. Estimate temperature above fire
  3. Behavior of flame plumes
  4. Buoyancy
- N. Combustion products
  1. Nature and level
  2. Yield smoke
  3. Hazards
- O. Compartment fires
  1. Fire development
  2. Flashover
  3. Fully developed fires
  4. Ventilation factors
  5. Fire induced flows
  6. Computation
- P. Analytical applications
  1. Fire safety
  2. Fire investigation
- Q. Fire modeling

#### VI. METHODS OF INSTRUCTION:

- A. **Audio-visual Activity** - DVD Video's
- B. **Written exercises and case studies** - Individual assigned essay
- C. **Lecture** -
- D. **Student Presentations** - Assigned subject presentation
- E. **Discussion** -
- F. Group Project

#### VII. TYPICAL ASSIGNMENTS:

- A. Student Presentations of selected common flammable liquids and combustible liquids or gasses
- B. Individual Essays regarding heat and its effects on Molecular Compounds
- C. Group Presentation on fire and the physical world and methods of various control and common extinguishment tools available to man

#### VIII. EVALUATION:

##### A. **Methods**

1. Exams/Tests
2. Quizzes
3. Oral Presentation
4. Projects
5. Group Projects
6. Class Participation

##### B. **Frequency**

1. Bi-weekly quizzes
2. One midterm exam
3. One group project presentation
4. One individual assigned essay
5. One assigned subject for oral presentation
6. One final exam

IX. TYPICAL TEXTS:

1. Gann, Richard, and Raymond Friedman. *Principles of Fire Prevention and Chemistry*. 4/e Ed ed., Jones and Bartlett Learning, 2016.
2. Quintiere, James. *Principles of Fire Behavior*. 2nd ed., Taylor and Francis Group, 2016.
3. Shackelford, Raymond. *Fire Behavior and Combustion Processes*. 1st ed., Cengage Learning, 2008.
4. NFPA. *Fire Protection Handbook*. 20th ed., NFPA, 2008.

X. OTHER MATERIALS REQUIRED OF STUDENTS:

- A. LPC Fire Service Technology Uniform