



MERCER
COUNTY COMMUNITY COLLEGE

COURSE OUTLINE

Course Number
FIR 201

Course Title
Hazardous Materials

Credits
3

Hours: 3
Lecture/Lab/Other

Co- or Pre-requisite: High School Chemistry or
CHE 100 or Equivalent Background

Implementation
Semester & Year
January 2022

Catalog description:

Study of basic fire chemistry relating to the categories of hazardous materials including problems of recognition, reactivity, and health encountered by firefighters.

General Education Category:

Not GenEd

Choose an item.

Course coordinator:

James McCann, (609) 799-3245 or mccannj@mccc.edu

Required texts & Other materials:

Jones & Bartlett, Hazardous Materials: Managing the Incident, Revised Fourth Edition
ISBN: 9781449670849

Course Student Learning Outcomes (SLO):

Upon successful completion of this course the student will be able to:

1. This course provides basic fire chemistry relating to the categories of hazardous materials including problems of recognition, reactivity and health encountered by firefighters. (ILG 1, 2, 3, 4, 9, 11), (PLO 1, 2, 3, 4, 5, 6, 7)
2. Identify the common elements by their atomic symbols on the Periodic Table and demonstrate an understanding of why the table is organized into columns and groups. (ILG 1, 3), (PLO 2)
3. Explain the difference between ionic and covalent bonding and be able to predict when each will occur. (ILG 1, 3), PLO (3)
4. Comprehend the basic chemical and physical properties of gases, liquids and solids, and predict the behavior of a substance under adverse conditions. (ILG 1, 3, 11), (PLO 2)
5. Identify, name, and understand the basic chemistry involved with common hydrocarbon derivatives. (ILG 1, 3), (PLO 2)
6. Identify, name, and understand the basic chemistry and hazards involved with the nine U.S. Department of Transportation hazard classes and their divisions. (ILG 1, 2, 3, 4, 9, 11), (PLO 1, 2, 3, 4, 7)
7. Analyze facility occupancy, transportation documents, shape and size of containers, and Material Safety Data Sheets (MSDS) to recognize the physical state and potential hazards of reactivity related to firefighter health and safety. (ILG 1, 2, 3, 4, 5, 11), (PLO 1, 2, 3, 4, 5, 7)
8. Demonstrate the ability to utilize guidebooks to determine an initial course of action for emergency responders. (ILG 1, 4, 11), (PLO 1, 2, 3, 6)

Course-specific Institutional Learning Goals (ILG):

Institutional Learning Goal 1: Written and Oral Communication in English:

Students will communicate effectively in both speech and writing.

Institutional Learning Goal 2: Mathematics: Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.

Institutional Learning Goal 3: Science: Students will use the scientific method of inquiry, through the acquisition of scientific knowledge.

Institutional Learning Goal 4: Technology: Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.

Institutional Learning Goal 9: Ethical Reasoning and Action: Students will understand ethical frameworks, issues, and situations.

Institutional Learning Goal 11.

Critical Thinking: Students will use critical thinking skills understand, analyze, or apply information or solve problems.

Program Learning Outcomes for (PLO)

1. Discuss the history, support organizations, resources, incident management, training, and emergency operations and relate how each plays a role within the fire service;
2. Define and use basic terms and concepts associated with the chemistry and dynamics of fire;
3. Apply principles of hydraulics, building construction, strategy, and tactics to fire ground operations;
4. Communicate the relationship of fire prevention and fire inspection;
5. Demonstrate the importance of public education in relation to fire prevention;
6. Evaluate facilities to appraise code compliance and potential hazards, building construction issues, and presence of appropriate fire protection systems to help ensure life safety both pre-incident and during an incident;
7. Employ safe work practices using recognized standards and regulations

Units of study in detail – Unit Student Learning Outcomes:

Learning Objectives The student will be able to:

I. Introduction (Supports SLO 1, 2, 7, 8, 9)

Describe and recognize each of the following:

- A. General Characteristics of Hazardous Materials
- B. Hazardous Household Products
- C. Hazardous Substances in the Workplace
- D. Hazardous Materials in Transit
- E. Hazardous Materials within Communities
- F. NFPA System of Identifying Potential Hazards

II. Matter and Energy (Supports SLO 2, 4, 5, 6)

Understand, define and describe the following:

- A. Matter and Energy
- B. Common Units of Measurement
- C. Temperature, Pressure, and Volume Relationships
- D. Heat Transmission
- E. Understanding Fluid Principles

III. Chemical Forms of Matter (Supports SLO 2, 4, 5, 6)

Understand, define and describe the following:

- A. Elements and Compounds
- B. Periodic Classification of Elements
- C. The Nature of Chemical Bonding
- D. Writing Chemical Formulas
- E. Naming Ionic and Covalent Compounds

IV. Chemistry of Some Common Elements (Supports SLO 2, 4, 5, 6)

Define and understand the nature of the following:

- A. Oxygen
- B. Hydrogen
- C. Fluorine
- D. Chlorine
- E. Phosphorus
- F. Sulfur
- G. Carbon

V. Principles of Chemical Reactions (Supports SLO 2, 4, 5, 6)

Understand and describe:

- A. Types of Chemical Reactions
- B. Factors Affecting the Rate of Reaction
- C. Oxidation-Reduction Reactions
- D. Fire Extinguishing Agents

VI. Flammable Gases and Liquids (Supports SLO 2, 4, 5, 6)

Understand and describe each of the following:

- A. Flammability
- B. General Hazards of Compressed Gases
- C. Storage and Transport of Compressed Gases
- D. General Hazards of Flammable Liquids
- E. Storage and Transport of Flammable Liquids
- F. Response to Flammable Gas and Liquid Emergencies

VII. U.S. Department of Transportation Hazard Classes & Their Divisions (Supports SLO 7, 8, 9)

Understand and identify each of the following:

- A. Identification of Hazardous Materials by Container Shape and Size
- B. Identification of Hazardous Materials by Transportation Placards
- C. Identification of Hazardous Materials by Shipping Documents
- D. Identification of Hazardous Materials by Material Safety Data Sheets (MSDS)

VIII. Hazardous Materials in Fixed Facilities (Supports SLO 7, 8, 9)

Understand and identify each of the following:

- A. Identification of Hazardous Materials by Location and Occupancy
- B. Identification of Hazardous Materials by Container Shape and Size
- C. Identification of Hazardous Materials by NFPA 704 System
- D. Identification of Hazardous Materials by Material Safety Data Sheets (MSDS)

IX. Response Guidelines (Supports SLO 7, 8, 9)

Understand, identify and use each of the following:

- A. Utilization of North American Emergency Response Guidebook
- B. Utilization of NIOSH Pocket Guide to Chemical Hazards
- C. Utilization of NFPA Fire Protection Guide to Hazardous Materials
- D. Utilization of Bureau of Explosives Emergency Action Guides

X. Chemistry of Some Hazardous Organic Compounds (Supports SLO 2, 4, 5, 6)

Define and understand the nature of the following:

- A. The Nature of Organic Compounds
- B. Aliphatic Hydrocarbons
- C. Aromatic Hydrocarbons
- D. Functional Groups
- E. Halogenated Hydrocarbons
- F. Alcohols
- G. Ethers
- H. Aldehydes and Ketones
- I. Organic Acids
- J. Esters
- K. Amines
- L. Peroxo-Organic Compounds

XI. Chemistry of Some Corrosive Materials (Supports SLO 2, 4, 5, 6)

Define and understand the nature of the following:

- A. The Nature of Acids and Bases
- B. The PH Scale
- C. Acids and Bases as Corrosive Materials
- D. Sulfuric Acid
- E. Nitric Acid
- F. Hydrochloric Acid
- G. Perchloric Acid
- H. Hydrofluoric Acid
- I. Phosphoric Acid
- J. Acetic Acid
- K. Alkaline Metal Hydroxides
- L. Response to Corrosive Material Emergencies

XII. Chemistry of Some Water-Reactive Materials (Supports SLO 2, 4, 5, 6)

Understand and describe the following:

- A. The Nature of Water Reactive Materials
- B. Alkali Metals
- C. Combustible Metals
- D. Metallic Hydrides
- E. Metallic Phosphides
- F. Metallic Carbides

Evaluation of student learning: Students will be evaluated for mastery of learning objectives by methods of evaluation to be determined by the instructor. Periodic tests or quizzes as well as a final exam may be utilized. Other methods such as a research papers or group projects are encouraged. Students must reference the course syllabus for their section for the evaluation details.