# FIRE-506: FUNDAMENTALS OF FIRE BEHAVIOR AND COMBUSTION (FORMERLY FIRE-106)

**Effective Term**
Fall 2026

**BOT Approval Date**
12/11/2025

**Discipline**
FIRE - Fire Technology
**Course Number**
506

**Course Title**
Fundamentals of Fire Behavior and Combustion (formerly FIRE-106)

**Short Title**
Fundamentals of Fire Beh/Combu

**Credit Status (CB 04)**
D - Credit - Degree applicable

## Units

**Lecture Units**
3.00

**Total Units**
3.00

## Hours

**Lecture Contact Hours**
48-54
**Out of Class Hours Lecture**
96-108

**Total Contact Hours**
48 - 54

**Total Out of Class Hours**
96 - 108

**Total Student Learning Hours**
144 - 162

**Distance Education**
Yes

## Distance Education

**Distance Education Type**
Both Fully Online and Hybrid Online

**Fully Online Delivery Requirements:**
**a. Students must be notified via the college schedule of classes and the syllabus for the class if proctored tests are required for this course**

**b. Any planned face-to-face meetings, such as an orientation or study session, must be optional**
**c. The MSJC curriculum committee requires the use of accessible, asynchronous discussion as a component of every fully online course**

**Are you using publisher content?**

No

**Regular Substantive Interaction**

Instructor-to-student, student-to-student, and student-to-content contact shall be distributed in a manner that will ensure regular substantive interaction (RSI) is maintained not only weekly but also for the duration of the course. Instructor interactions should be equivalent in time, quality and consistency to the engagement students would receive in a face-to-face course—for example, through announcements, discussion participation, personalized feedback, video messages, or other instructional communications. Instructors are expected to be responsive to student inquiries within a 24-72 hour time frame excluding holidays. RSI will be maintained through a variety of methods: • Orientation - Students must be oriented to the online and face-to-face portions at the start of the course. • Announcements - Announcements using the course management system must be posted at least weekly to keep students current on course events, due dates, materials, etc. • Discussion Forums - Content-related discussion forums within the designated CMS will include appropriate instructor participation and will be initiated and maintained, with timely feedback provided. Instructors are required to monitor the discussions and related activities to provide guidance and direction. Open-ended discussion boards may be used to further learning and interaction. • MSJC Communication – Instructor will use MSJC-administered communication tools (such as email or the designated CMS communication tools) to regularly communicate with and provide ease of access to students. • Timely Feedback - Timely feedback on student work will be provided by the instructor, which may include comments and/or rubrics, within the Grades area of the designated CMS. • Scheduled Meetings – Hybrid and synchronous courses will meet at regularly scheduled times. ADA Compliance - All course interactions and content must be designed with accessibility in mind and meet ADA requirements.

**Additional Regular Substantive Interaction**

The course will meet asynchronously for the fully online version using the CMS to engage with all course materials and complete assignments. Students may be required to create accessible videos with closed captions of [themselves performing or doing something involving course content. Hybrid sections will meet synchronously once a week via teleconferencing meetings as an Online Real-Time course, or as a hybrid course, they will meet fully face-to-face once a week with the rest fully online via the CMS. Students may be required to create accessible videos with closed captions engaging with course content and upload them into the CMS for feedback and to ensure proper understanding and performance of course content, this will be at the discretion of the instructor. Some assignments may be included in a live synchronous meeting via teleconferencing. Students will receive feedback from faculty regarding assignments performed live in synchronous meetings. Testing may occur using the CMS, or in a live classroom for hybrid courses.

**Catalog Description**

This course provides the student with fundamental information and knowledge of the physical and chemical characteristics of matter, fire, hazardous materials, extinguishing agents and fire control techniques. (formerly FIRE-106)

## Codes

**TOP Code (CB 03)**

2133.00* - *Fire Technology

**CIP Code**

43.0203 - Fire Science/Fire-fighting.

**Repeatability Code**

No

**Grading Option**

Letter grade OR P/NP

**Minimum Qualifications**

| Minimum Qualifications | And/Or |
|---|---|
| Fire Technology | End |

## Learning Objectives

**Learning Objectives**

| Learning Objective |
|---|
| 1. Understand the fundamentals of fire behavior, including ignition, flame propagation, and heat transfer. |
| 2. Analyze the factors that influence combustion, such as fuel types, temperature, and oxygen availability. |
| 3. Evaluate fire growth stages, including the pre-flashover, flashover, and post-flashover phases. |
| 4. Identify the principles of fire suppression, focusing on extinguishing methods such as cooling, smothering, and inhibiting chemical reactions. |
| 5. Explain the role of ventilation in fire behavior, including how ventilation affects fire spread and smoke movement. |
| 6. Assess the impact of building construction on fire behavior, examining how materials and design influence fire dynamics. |
| 7. Study the behavior of various fuels in different fire environments and how they contribute to fire development. |
| 8. Investigate fire suppression systems, including sprinklers, foam systems, and their effectiveness in controlling combustion. |
| 9. Recognize how diverse perspectives and experiences can influence fire safety protocols, ensuring all communities are considered in fire prevention and safety planning. |
| 10. Evaluate the challenges and opportunities of incorporating DEI in fire behavior training, ensuring equal access to education and fire safety knowledge across diverse populations. |

## Learning Outcome Information

**Course Learning Outcomes**

| Learning Outcome |
|---|
| 1. Students will define the physical properties and states of matter and describe the impact the combustion process may have on each. |
| 2. Students will identify various types of fuels, discuss the impacts of the combustion process on the material and hazards firefighters may encounter during suppression activities. |
| 3. Students will explain the physical characteristics of fire and how they impact the tactics and strategy of firefighting. |
| 4. Students will describe the process of burning and the effects of water and other suppression agents that have on fire, as well as the techniques and strategies of extinguishment. |

## Content

**Course Lecture Content**

1. Introduction to Fire Behavior and Combustion
   a. Definition of Fire: Understanding fire as a chemical reaction involving heat, fuel, and oxygen (the fire triangle). The fire tetrahedron (Adding chemical chain reaction) and types of combustion: Complete combustion, incomplete combustion, smoldering vs. flaming combustion.
      i. Fire Classification: Class A, B, C, D, and K fires and their characteristics.
2. Basic Principles of Combustion
   a. Heat Transfer Methods: Conduction (heat transfer through materials), convection (heat transfer through fluids), and radiation (transfer of heat through electromagnetic waves).
   b. Ignition and Flame Propagation: Ignition temperature, autoignition, flame spread rate.
   c. Stoichiometry of Combustion: Balanced chemical equations for combustion reactions, air-fuel ratio for efficient combustion, oxygen and fuel availability in combustion efficiency.
3. Fire Dynamics and Fire Growth
   a. Stages of Fire Development: Incipient stage (early stages of combustion), growth stage (fire begins to spread), fully developed stage (fire reaches its peak intensity), decay stage (fire begins to decrease).
   b. Heat Release Rate (HRR): Calculating HRR and its impact on fire spread, influence of fuel load on HRR.
   c. Flashover: Definition and importance, conditions leading to flashover, flashover prediction and prevention.
4. Fire Behavior in Different Fuels
   a. Fuel Types and Characteristics: Solid fuels (wood, paper, plastics), liquid fuels (gasoline, oils, alcohols), gas fuels (propane, methane, natural gas).
   b. Combustion Characteristics of Various Fuels: Ignition temperatures and burn rates of various fuels, heat release and smoke generation of common fuels.

   c. Fire Growth and Spread in Residential and Commercial Structures: Effects of building materials on fuel combustion, fire behavior in open vs. confined spaces.
5. The Role of Ventilation in Fire Behavior
   a. Ventilation Principles: How air supply influences fire spread, positive vs. negative pressure ventilation.
   b. Ventilation-Controlled vs. Fuel-Controlled Fires: Identifying fire behavior based on ventilation, understanding when fire becomes ventilation-controlled.
   c. Smoke Movement and Toxic Gases: Behavior of smoke in a fire, toxic gas production and evacuation strategies.
6. Fire Suppression Systems and Techniques
   a. Fire Extinguishment Methods: Cooling (water-based methods), smothering (CO2, foam, dry chemicals), chemical inhibition (fire extinguishers with halon or dry chemical agents).
   b. Sprinkler Systems: Types of sprinkler systems (wet, dry, pre-action), how sprinkler systems interact with fire behavior.
   c. Foam and Water-Based Systems: Different types of foam (Class A, Class B), applications and limitations of foam systems.
7. Fire Behavior in Building Materials and Construction
   a. Fire Resistance of Building Materials: Heat resistance of materials like concrete, wood, and steel, how materials change when exposed to high heat (e.g., charring, warping).
   b. Building Design and Fire Dynamics: Compartmentalization of fire in buildings, importance of fire-rated walls and ceilings.
   c. Fire and Structural Integrity: Effects of fire on structural materials (steel, wood, concrete), how fire weakens materials and contributes to collapse.
8. Fire Detection and Alarm Systems
   a. Detection Technologies: Smoke detectors (ionization vs. photoelectric), heat detectors (fixed vs. rate-of-rise), flame detectors (UV, IR sensors).
   b. Alarm Systems and Response: How detection triggers alarms and suppression systems, types of alarm systems (audible, visual, remote).
   c. Integration with Fire Suppression Systems: Coordinating detection, alarms, and suppression, the role of alarm systems in life safety and containment.
9. Safety Protocols and Firefighting Tactics
   a. Firefighter Safety: Protective gear (PPE): SCBA, turnout gear, safety procedures during fire attack (stay low, watch for flashover).
   b. Firefighting Strategies: Offensive vs. defensive strategies, strategic fire attack and suppression techniques, importance of pre-incident planning.
   c. Incident Command and Safety Protocols: Standard operating procedures (SOPs) for managing fire incidents, importance of situational awareness and decision-making under stress.
10. Advanced Topics in Fire Behavior and Combustion
   a. Fire Modeling and Simulation: Computational fluid dynamics (CFD) in fire modeling, fire modeling software: Applications and use cases.
   b. Wildland Fires: Combustion in wildland environments (forests, grasslands), factors influencing wildland fire spread (wind, fuel load, topography), fire behavior in wildland-urban interface areas.
   c. Emerging Technologies: New advancements in fire detection, suppression, and analysis (drones, sensors), role of AI and big data in fire prediction and management.
11. Case Studies in Fire Behavior
   a. Analyzing Real-World Fire Incidents: Detailed analysis of past fire incidents (e.g., warehouse fires, wildfires), lessons learned from major fire events.
   b. Fire Investigations: Investigating fire cause and origin using fire behavior principles, understanding burn patterns and fire spread.
12. Identify how factors like building stock, occupancy type, culture/language, socioeconomics and community resources influence fire behavior and hazard exposure.
   a. Use diverse real-world examples of housing, fuels, and heating methods to show how environmental and cultural factors alter ignition and spread (e.g., propane vs. biomass stoves)

## Methods of Instruction

**Method**

Activity

**Integration**

Hands-on activities such as in-class group discussions and research assignments to analyze fire department public and private support organizations and the development of a fire department organizational chart for a given fire department.

**DE Adaptations for MOI**

Students will work in small groups in breakout rooms within accessible video conferencing software to research, collaborate, brainstorm, work on a project, or discuss future activities. All audio and visual aids will meet ADA requirements.

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**Method**

Discussion

**Integration**

In-class and/or group discussion will be used to enhance student understanding of the physical and chemical properties of fire in relationship to characteristics of various extinguishing agents, including water. Along with the identification of the physical properties of the three states of matter and how the physical state relates to the burning process.

**DE Adaptations for MOI**

Students will participate in online lectures and discussions with interaction between students and the instructor. This interaction will take place in both a online discussion setting and online video conferencing that meet ADA visual and audio requirements.

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**Method**

Homework

**Integration**

Out of class reading assignments and summaries of that reading to enhance student comprehension of basic material such as fire department structure and operation, educational and experience requirements for fire department jobs, and safety concerns associated with fire fighting.

**DE Adaptations for MOI**

Homework assignments are assigned through CMS and will allow students to submit all coursework electronically and receive feedback from the instructor. Homework and instructions for each assignment will have a recorded lesson that students may look at whenever they need review.

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**Method**

Lecture

**Integration**

Lecture presentation using slides and other media presentations describing all aspects of fire protection chemistry and fire suppression methods. The lectures will also cover current trends in the fire services, including hiring practices and DEI impact on the fire service and the community.

**DE Adaptations for MOI**

Online lessons will be presented by the instructor and supplemented by videos and demonstrations. All lectures will be recorded for online viewing if the student is not able to attend the scheduled lecture. All online presentations will be recorded and be accessible with closed captions.
The lectures will also cover current trends in the fire services, including hiring practices and DEI impact on the fire service and the community.

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**Method**

Observation and Demonstration

**Integration**

Slides and other forms of media may be used to demonstrate and illustrate fire department structure and operation and the inherent dangers and unsafe conditions associated with fire fighting. Video clips of actual incidents along with incident reviews may be used to demonstrate fire ground operations and recognition of unsafe conditions

**DE Adaptations for MOI**

Online lessons will include videos, live recorded events from real-life fire inspections, fire protection system activation, and public education. All online presentations will be recorded and be accessible with closed captions.

## Methods of Evaluation

**Method**

Class Participation

**Integration**

Students will be encouraged to participate in class discussions and activities and will be evaluated on their involvement and performance in the discussions and class activities. Students will be asked open-ended and overhead questions by the instructor that will ensure the message and lesson is being received and understood by the students

**DE Adaptations for MOE**

Students will work within online subgroups during video conference classes to discuss current assignments and present group ideas, discussions, and projects. Students will receive credit for attending and for participating in the discussions. he assignments will be submitted every week via CMS. These can include discussion boards, multiple-choice quizzes, and short answer questions. The instructor will give feedback and grades to the students, within 48 hours of CMS submissions.

**Method**

Exams/Tests

**Integration**

Quizzes, a midterm and final examination will be given to evaluate content understanding of terminology, knowledge of subject matter, and ability to contrast and categorize the three states of matter, various fire extinguishing techniques and agents and the components of fire.

**DE Adaptations for MOE**

Quizzes, mid-term, and a Final exam will be administered via CMS. All multiple choice exams will be graded instantly by the CMS after the students submits the exam and allows the student to view the correct answer. Exams that have written answers, will be submitted by the student via CMS and the instructor will grade and give student feedback within 72 hours.

**Method**

Homework

**Integration**

Students will be evaluated on their written assessments of the principles of fire behavior and combustion including toxic by-products of combustion, heat transfer and fuels.

**DE Adaptations for MOE**

All assignments will be submitted via CMS and graded per the course syllabus and rubric for each assignment. The instructor will have all student assignments graded within one week of submission.

**Method**

Papers

**Integration**

Students will be evaluated on written reports and research paper assignments. Writing skills as well as assignment content, accuracy and research sources will be evaluated.

**DE Adaptations for MOE**

Students will submit all coursework, including research papers and resumes, via CMS to be graded by the professor. Each assignment has its own rubric and will be graded accordingly. Feedback will be given to the students within the CM

**Method**

Group Projects

**Integration**

In class group projects such as research and presentation of information on topics such as what influences public and private support organizations have on the fire services will be evaluated on the accuracy and completeness of the information presented. Students will be evaluated on contribution to the group and participation

**DE Adaptations for MOE**

Students will work collaboratively with other students to discuss ideas within the fire service and current affairs that relate to the fire service and then present their findings to the class in an online video conference meeting. Participation is recorded and students will be given credit that will be entered as part of their overall grade in the class for the participation. he assignments will be submitted every week via CMS. These can include discussion boards, multiple-choice quizzes, and short answer questions. The instructor will give feedback and grades to the students, within 48 hours of CMS submissions.

## Assignments

**Assignment Type**

Reading

**In-class and/or outside of class**

In-class

**Formative or Summative**

Formative

**Assignment**

Reading:
Chapter 1 – The Combustion Process
Topics include:

Definition and types of combustion

Conditions necessary for combustion

Exothermic reactions and energy release

Fire triangle and tetrahedron

The role of oxidizers and fuels

Assignment Tasks:
Reading Summary (1 page max):
In your own words, summarize the key scientific principles discussed in Chapter 1. Describe how the fire triangle and tetrahedron illustrate the conditions necessary for combustion. Identify the significance of understanding chemical reactions and fuel properties when evaluating fire behavior.

Short Answer Questions:
a. What is the difference between complete and incomplete combustion, and why does it matter in fire behavior?
b. How does the fire tetrahedron expand on the traditional fire triangle, and what does this imply for fire suppression strategies?
c. Why is it important for firefighters and fire investigators to understand the chemical basis of fire?

**How assignment will be adapted in online format**

Read assignments or posts during class and discuss them as a group. Each chapter will have a reading assignment that will be performed in class and then discussed as a group. Students will read and evaluate posts in groups via CMS online video conferencing break-out rooms and then come together to discuss the solution in the larger group
Each chapter will have a reading assignment that will be performed during the scheduled online class session and then discussed collaboratively.
Students will read and evaluate posts in groups via CMS online video conferencing break-out rooms and then come together to discuss the solution in the larger group.

Using the course's online learning platform and integrated video conferencing tools, students will be placed into breakout rooms to read the assignment and evaluate prompts or case studies as a team. After group discussion, all students will reconvene in the main session to share insights, compare interpretations, and participate in a guided, instructor-led discussion with the entire class.

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**Assignment Type**

Other

**In-class and/or outside of class**

In-class

**Formative or Summative**

Formative

**Assignment**

Group Project Assignment: Incendiary Device Analysis
Course: Fundamentals of Fire Behavior and Combustion
Assignment Type: Group Research Project (Written + Oral Presentation)
Points Possible: 100

Assignment Overview:
Working in assigned groups, students will research a selected incendiary device, analyze its function, and present findings both in writing and through an oral presentation. This project is designed to foster teamwork, enhance research skills, and connect course concepts—such as combustion chemistry, ignition methods, and heat transfer—to real-world incendiary mechanisms.

Objectives:
Collaborate effectively in a team environment

Analyze the construction and operational function of an incendiary device

Apply course concepts to explain its behavior and combustion properties

Communicate findings through clear written and oral formats

Consider multiple configurations and hypothetical scenarios related to device deployment

Assignment Components:
1. Written Report (60 points)
Minimum 3–5 pages, double-spaced, properly cited (APA or MLA)

Include the following:

Description and technical breakdown of the incendiary device

Explanation of how the device operates, referencing fire behavior principles

At least two hypothetical scenarios explaining variations in the device's function (e.g., fuel source changes, environmental conditions)

Summary of credible sources used in your research

Accuracy, depth of analysis, and use of course terminology are key grading criteria

2. Oral Presentation (30 points)
10-minute group presentation delivered via CMS-integrated video conferencing or in class

Each group member must contribute

Use visual aids (e.g., slides or diagrams) to enhance clarity

Summarize key findings and explain the scenarios analyzed in the report

3. Team Collaboration (10 points)
Demonstrate effective group coordination and equitable division of responsibilities

Submit a brief team reflection or individual peer evaluations if required by the instructor

Grading Breakdown:
Written Report 60
Oral Presentation 30
Group Collaboration & Effort 10
Total 100

Upload the group's written report as a PDF to the CMS
Be prepared to present during the scheduled class session (online or in person)

**How assignment will be adapted in online format**

While in a video conferencing setting, students will be placed into break-out groups to work with other students to present their findings and discuss fire-related topics. The assignment will be given to the students during the online class. These assignments will be graded for participation, rather than graded via rubric.

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**Assignment Type**

Writing

**In-class and/or outside of class**

Outside of class

**Formative or Summative**

Summative

**Assignment**

Assignment Title: Fire Behavior and DEI in Diverse Communities
Course: Fundamentals of Fire Behavior and Combustion
Assignment Type: Written Analysis + Peer Discussion
Points Possible: 100

Purpose of Assignment
This assignment integrates Diversity, Equity, and Inclusion (DEI) concepts with scientific principles of fire behavior and combustion. It encourages you to critically analyze real-world fire scenarios and reflect on how structural, environmental, and cultural differences affect fire dynamics, fire prevention, and emergency response outcomes.

Assignment Overview
You will choose a real-world fire incident and examine how various factors—including fuel types, construction materials, environmental conditions, and socio-economic disparities—impacted fire behavior and emergency response. Then, you will reflect on how fire science professionals can integrate DEI principles into their prevention strategies, education efforts, and operational practices.

Assignment Instructions
Part 1: Case Study Analysis (60 points)
Write a 750–1,000 word analysis of a real-world fire incident. Address the following:

Describe the fire scenario (location, type of structure/environment, timeframe, and outcome).

Analyze how fire behavior and combustion were influenced by:

Fuel load and material composition

Environmental or weather conditions

Structural design and layout

Identify any disparities in:

Community preparedness or evacuation response

Access to fire protection systems (e.g., sprinklers, alarms)

Fire department response capabilities

Discuss how DEI factors (e.g., cultural norms, language barriers, economic inequality) may have influenced the incident's outcome or response efforts.

Part 2: DEI Reflection (20 points)
In 2–3 well-developed paragraphs, reflect on the following:

How can an understanding of fire behavior help better serve diverse communities?

What inclusive practices can be applied to improve fire prevention, public education, or suppression in vulnerable populations?

How can empathy and cultural awareness enhance the role of a fire service professional?

Part 3: Peer Engagement (20 points)
Post a 100–150 word summary of your case study on the course discussion board.
Respond to at least two classmates' posts by:

Offering a thoughtful comment or question about their case study

Noting a new perspective or learning insight you gained

Highlighting how their example deepens your understanding of fire behavior or DEI considerations

Grading Rubric
Case Study Content & Analysis 60
DEI Reflection (insight & application) 20
Peer Discussion Engagement 20
Total 100

Submit your written analysis and DEI reflection as a single PDF or Word document.

Post your case study summary in the CMS discussion board by [Insert Due Date].

Peer replies are due by [Insert Peer Response Deadline].

**How assignment will be adapted in online format**

This online assignment is designed to encourage students to explore how Diversity, Equity, and Inclusion (DEI) intersect with the scientific principles of fire behavior and combustion.

Students will critically analyze how cultural, environmental, and demographic factors can influence fire development, suppression strategies, and safety outcomes in a variety of community settings. Through guided reflection and case-based application, students will consider how fire behavior principles—such as fuel properties, ignition conditions, and heat transfer—manifest differently across diverse populations and built environments.

Each chapter of the course will include at least one assignment submitted through the course management system (CMS) to demonstrate subject mastery. These weekly assignments may include:

Discussion boards on fire dynamics in diverse contexts

Multiple-choice quizzes on combustion processes, heat transfer, and flame spread

Short answer reflections connecting fire science to real-world fire incidents and equity-focused response strategies

All assignments will be submitted through the CMS, and the instructor will provide timely, personalized feedback and grades within 48 hours of submission to ensure ongoing progress and support.

This approach reinforces technical knowledge while helping students recognize the importance of inclusive, culturally aware practices in fire prevention, suppression, and investigation.

## Course Materials

**Textbooks**

Principles of Fire Behavior and Combustion, 5th Edition (2023) by Richard G. Gann, National Fire Protection Association ISBN: 978-1284198584

No newer reading content available.

## Class Size Information

**Class Size**

40

**Class Size Category**

A - Lecture/discussion 40

## Diversity and Inclusion

Course Design and Materials: Course will incorporate diverse perspectives, authors, and examples that reflect a variety of cultures, identities, and lived experiences. Instructional materials will be reviewed regularly to ensure representation, inclusivity, and alignment with equity-minded practices across disciplines.

Inclusive Learning Environment: Instructors will establish classroom norms and policies that promote respect, civil discourse, and belonging in both online and face-to-face classes. Clear expectations for communication and engagement will support a learning space where all students feel valued and heard.

Accessible Instruction: Course content will be delivered using accessible design. Materials will follow accessibility guidelines within the CMS, including captioned media, readable document formats, and multiple means of engagement to support diverse learning.

Equitable Teaching Practices: Instructors will use transparent and grading criteria, varied assessment methods, and timely feedback to promote fairness and student success. Opportunities for revision, reflection, and multiple demonstrations of learning may be incorporated when appropriate to the discipline.

Culturally Responsive Pedagogies: Instructional strategies will encourage critical thinking about diverse perspectives and systems of power relevant to the course content. Faculty will foster opportunities for students to connect course material to real-world contexts.

Ongoing Reflection and Improvement: Faculty will engage in continuous professional development related to IDEAA principles and reflect on course practices using metacognition to identify opportunities for increased equity, inclusion, and accessibility.

**Explain how diversity and inclusion(e.g., gender, culture/race, sexuality, etc.) is infused into the course.**

The Fundamentals of Fire Behavior and Combustion course embraces diversity and inclusion by incorporating inclusive language, diverse learning materials, and case studies that reflect individuals of different genders, cultures, races, and backgrounds within the fire service and fire science community. Real-world scenarios are drawn from a variety of environments—urban, wildland, and industrial—to ensure all students can connect with the material through their lived experiences and perspectives.

Collaborative learning activities are designed to promote interaction among students from diverse backgrounds, fostering an inclusive, respectful, and supportive learning environment. Students are encouraged to bring their unique perspectives to discussions on fire dynamics, heat transfer, and combustion-related problem-solving.

Assessment methods are skill- and knowledge-based, transparent, and rooted in equitable practices. These methods ensure all students are fairly evaluated on their ability to apply scientific principles and critical thinking to real-world fire behavior scenarios.

The course also promotes values such as respect, empathy, and open-mindedness, cultivating a safe and welcoming classroom where all voices are valued. By embedding diversity and inclusion into the curriculum, the course not only builds technical knowledge, but also prepares students to thrive and contribute effectively in a diverse and evolving fire service workforce.

**Describe how assignments, instruction, evaluation, course content, and interactions are contextualized for diverse learners promoting an equitable course.**

In the Fundamentals of Fire Behavior and Combustion course, a commitment to equity is reflected through thoughtfully designed assignments, inclusive instructional practices, equitable evaluation methods, and diverse course content. Online lessons provide flexibility to accommodate varied learning styles, preferences, and accessibility needs, while in-person instruction incorporates a range of strategies—such as visual models, live demonstrations, and multimedia presentations—to engage all learners.

Evaluation methods are grounded in industry standards and designed to be transparent, fair, and free from bias, ensuring all students have equal opportunities to demonstrate their understanding of core topics such as fire development, heat transfer, and combustion principles.

Course content integrates diverse perspectives and real-world applications, ensuring students see themselves and their communities reflected in the material. This includes case studies and scenarios that highlight a variety of structural, environmental, and cultural factors influencing fire behavior and firefighting approaches.

Online and in-person discussions are structured to foster respectful and inclusive dialogue, where all students are encouraged to contribute and feel heard. By embracing these inclusive and student-centered practices, the course promotes an equitable learning environment that supports the diverse needs, strengths, and experiences of all students.

## Interactions

**Explain how the course will incorporate student-to-student interaction.**

Accessible video conferencing platforms and integrated collaborative tools will enhance student-to-student interaction throughout the course. Students will work in small groups using video conferencing and discussion boards embedded within the course management system (CMS) to share ideas, analyze fire behavior scenarios, and collaborate on course assignments.

Within these collaborative settings, students will explore current developments in fire science, including emerging research on fire dynamics, heat release rates, flame spread, and combustion analysis. Group discussions will also focus on evaluating practical applications such as combustion demonstrations, fire behavior modeling, and the assessment of fire suppression system performance.

By working together, students will have opportunities to provide peer feedback on experimental findings, discuss fire behavior assessments, and review one another's evaluations of system effectiveness in real-world fire scenarios.

This interactive, group-based approach supports collaborative learning and promotes a deeper, more applied understanding of fire behavior and combustion principles critical to modern fire science and emergency response.

**Explain how the course will incorporate instructor-to-student interaction.**

Instructor-led video conferencing sessions and one-on-one meetings will serve as key components for promoting direct engagement between the instructor and students. These interactions—both in group discussions and individual settings—are designed to ensure students gain a comprehensive understanding of fundamental fire behavior concepts.

Throughout the course, the instructor will facilitate discussions using open-ended questions to foster critical thinking and deepen student comprehension. These questions will prompt students to reflect on the course material, share insights, and engage actively with core topics such as combustion processes, heat transfer, and fire dynamics.

For example, the instructor may pose questions such as:

“How does fire behavior change with varying fuel types and environmental conditions?”

“What are the primary challenges in controlling combustion during different fire scenarios, and how can they be addressed?”

“How do principles of heat transfer and fire growth influence modern building design and fire protection planning?”

“In what ways do fire behavior dynamics affect the operation and effectiveness of suppression systems?”

This instructional approach supports both formative assessment and interactive learning, allowing students to demonstrate understanding, ask questions, and apply fire behavior principles to real-world fire service scenarios.

**Explain how the course will incorporate student-to-content interaction.**

The course will also emphasize teaching students effective study strategies, fostering confidence through active participation, offering constructive peer feedback, and promoting self-reflection. A key assignment will require students to assess their own performance by grading one of their completed assignments. They will be expected to justify their grading decisions based on their effort, understanding, and application of key concepts related to fire behavior, combustion processes, and fire dynamics.

Student evaluation will include participation in class discussions—both in group formats and individual interactions—where active engagement and analytical thinking are encouraged. Assessment will also consider the timely completion of assignments, including the self-evaluation task. In this assignment, students will reflect on their academic progress, evaluate the quality of their own work, and justify their self-assigned grade using foundational principles such as heat transfer, ignition sources, fire development stages, and fuel characteristics.

Additionally, peer review will be integrated into the evaluation process. Students will engage with and critique one another’s work, providing meaningful, constructive feedback on topics like flame spread, fire growth patterns, extinguishing methods, and combustion chemistry. Overall, evaluations will measure each student’s ability to apply newly acquired knowledge, demonstrate a deeper understanding of fire behavior and combustion, and show measurable progress throughout the course.

**Explain how the course will incorporate student-to-self interaction (metacognitive).**

The course will also focus on equipping students with effective study strategies, fostering confidence through active participation, encouraging constructive peer feedback, and promoting self-reflection. A key assignment will involve students evaluating their own performance by grading one of their completed assignments. They will be expected to justify their grade based on their effort, understanding, and the quality of their work related to fundamental fire behavior concepts such as heat release, fuel types, stages of fire development, and combustion reactions.

Students will be assessed on their engagement in class discussions, both in collaborative group settings and one-on-one interactions, with an emphasis on critical thinking and analytical reasoning. Evaluation will also include the completion of assignments—most notably, the self-assessment exercise in which students reflect on their learning progress, evaluate their own work, and explain how their performance aligns with course objectives related to thermal decomposition, flame spread, and extinguishment techniques.

Peer feedback will play an integral role in the evaluation process. Students will review and provide thoughtful, constructive input on each other’s work, engaging with key topics such as ignition scenarios, heat transfer mechanisms, fire suppression strategies, and fire behavior indicators. Overall, the evaluation will measure each student's ability to apply core fire behavior and combustion principles, demonstrate academic growth, and reflect on their development throughout the course.

Key: 1588