



South Portland, Maine 04106

## Fire Science

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<b>Title: Fire Behavior/Combustion</b>	<b>Catalog Number: Fire 120</b>
<b>Credit Hours: 3</b>	<b>Total Contact Hours: 45</b>
<b>Lecture (or Lab): Lecture</b>	<b>Instructor: Robert Lindstedt</b>
<b>Office Hours – Location: Howe Hall rm. 200</b>	<b>Contact Information:</b>
	(O) 207-741-5750
	E-mail: rlindstedt@smccme.edu

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## Course Syllabus

### Course Description

Effective fire control and extinguishment requires a basic understanding of the chemical and physical nature of fire. This includes information describing sources of heat energy, composition and characteristics of fuels and the environmental conditions necessary to sustain the combustion process. This course will provide an opportunity to inquire, explore, understand, apply, and reflect on theories and concepts associated with how and why fires start, spread and are controlled in hopes of helping to develop highly competent fire service professionals.

**PRE-REQUISITE:** *MATH-140 College Algebra or MATH-130 Technical Math.* Because of the nature of this subject, students should be well versed in mathematics - particularly algebra, importance of units, and use of equations -- when enrolling in this course.

### Course Objectives

**After successfully completing the course, the student will be able to:**

1. Explain the physical and chemical properties of fire
2. Describe and apply the process of burning
3. Analyze building structural components for fire endurance and fire resistance.
4. Analyze the mission of fire protection agencies and explain how the use of proactive, reactive and leadership-management methods manage risks and contribute to mission success.
5. Understand the flame spread and smoke production properties of building furnishings and materials.
6. Identify the physical and chemical properties of combustible materials.
7. Categorize the components of fire
8. Define and utilize terms and concepts associated with the chemistry and dynamics of fire
9. Discuss various materials and their relationship to fires as fuel
10. Demonstrate knowledge of the characteristics of various suppression agents and strategies
11. Compare and contrast various methods, materials and techniques of fire extinguishment.

12. Analyze the basic components of fire as a chemical chain reaction, the major phases of fire, and examine the main factors that influence fire spread and fire behavior.
13. Differentiate between fire service training and education and explain the value of higher education to the professionalization of fire service and its personnel.

### Course Requirements

Students are expected to complete pre-class assignments, attend all classes and take notes. Students will be expected to actively participate in classroom discussions and group assignments. There are several written presentations which will be developed and presented by each student. Online quizzes and in-class quizzes and tests will also be given.

*Late assignments (papers, take-home quizzes, etc.) will not be accepted and will receive a grade of zero unless prior authorization is given by the instructor. All work is due at the start of the class period in which the assignment is due. If you are not in class the day homework is due, it is your responsibility to email it to the instructor prior to the start of class. All written assignments (other than your class notes) are to be typed neatly using MSWord, RTF or PDF file format, 11-12 point type only, properly formatted and stapled/bound as necessary. Failure to properly submit work will result in a grade of a zero “0”.*

### Student Evaluation and Grading

Attendance, participation/preparedness	20%	(this includes Friday Sessions)
Pre-class/In-class notes	20%	
Daily quizzes	10%	
Projects :	20%	
Exams (2)	30%	(15% each)

#### Letter Grade:

SMCC letter grades are based on the following percentages:

93-100 = A	90-92 = A-	87-89 = B+	83-86 = B
80-82 = B-	77-79 = C+	73-76 = C	70-72 = C-
67-69 = D+	63-66 = D	62-blow = F	0-59 = F

### Text, Tools and / or Supplies

**Fire Dynamics, 2nd<sup>t</sup> edition (2015), by Pearson Education Inc.**

**ISBN-10: 0-13-384270-3**

**ISBN-13: 978-0-13-384270-8**

-Students are encouraged to register with “MYBRADYKIT” using the access code that accompanies the text.

-Online content will be presented thru (MY SMCC under Handouts for this course) and via Student E-Mail.

### Attendance Policy

Because this class is interactive, each student’s class attendance, participation and reflections will be graded by the instructor. Each student is expected to come to class prepared to discuss the topic for the day and to

Week	Class Dates	Class Title	Topics	Microcosms & Foundational Questions	Pre-Class Assignments and Work Due:	Weekly Class Outcomes. Class Work due at end of class. Class Activities done during class.
1		Introduction / Syllabus / Course Expectations Ch 1: Introduction to Fire Dynamics	-Course Orientation -Intro CCFP Model -Why study fire	-Syllabus + Sch. -Accountability -motivation via understanding	Pre: Get textbook, get notebook, calculator -No Work Due	-understand course scope/sequence and relevance -understand course expectations _In class Note Taking Guide for chapter 1. -Choose a topic for research. -Schedules
2		Math Review (Ch.2)	-Algebra and Units of Measure	Math is the language of physical science. Data analysis leads to understanding. Application	-Chapter 2 Pre-class Note Taking Guide (PC-NTG) -part 3 of research due (6 articles associated with research, copies)	Daily quiz-1 CH 2 In Class NTG (IC-NTG) due -Review + practice session -Discussion on relevance
3		Chemistry Review (Ch. 3)	-Review of chemistry important to fire behavior -9 hazard classes	-Without chemistry there is no fire -What types of chemicals does the FSP need to know about?	-Ch. 3 PC-NTG -Part 4 of research due (list of 6 addresses of videos to be used in research)	Daily quiz-2 Ch. 3 IC-NTG due -Understand relationship between fire and chemistry -Chem 103 review -Discussion on relevance
4		Properties of Matter and Basic Physics (Ch. 4)	-Relationship between physics and fire	-without physics there is no fire -How does physics relate to fire?	-Ch. 4 PC-NTG -Part 6 of research due (data tables, graphs, charts or graphics to be used in research)	Daily quiz-3 Ch. 4 IC-NTG due -Understand the relationship between physics and fire -Discussion on relevance -update on research progress
5		FIRE (Ch. 5)	-Classes of Fire, Oxidation process, Flames, plumes and fire spread. Combustion	-What is FIRE?	-Take Home Exam 1 (first 4 chapters)-on-line -PC-NTG Ch. 5 -Part 7 of research due (List of possible future research topics associated with your topic)	-Rev. Exam 1 (q + a) -daily quiz-4 -IC-NTG Ch. 5 -know classes of fire -demonstrate knowledge of flame development and causes of spread
6		Gaseous Combustion (Ch. 6)	Dependency of Fire Flame propagation Gas explosions Warnings	What does fire depend on?	-Ch. 6 PC-NTG	-Ch. 6 IC-NTG -daily quiz -5 -Understand the concepts associated with gaseous fuel fires and relate them to PFF activities (def. /off strategies).
7		Ignitable Liquids (ch.7)	Classifications of liquids. Flam vs. Comb liquids. Liquid behaviors.	-What does the FSP need to know about liquids in order to function safely and efficiently?	-Ch. 7 PC-NTG -Part 11 of research due (handout of ppt slides 3 per sheet with note spaces)	Ch. 7 IC-NTG Daily quiz-6 --Understand the concepts associated with liquid fuel fires and relate them to PFF activities (def. /off strategies).

8		Ch. 8: Solid Combustion	Investigate how solids burn, various solid fuels including metals. Thermal inertia inquiry. Fire retardants.	-What does the FSP need to know about the burning characteristics and identification of solid fuels?	-Ch. 8. PC-NTG -part 10 of research due (interactive handout that will accompany ppt presentation)	- <b>daily quiz-7</b> -Ch. 8 IC-NTG ---Understand the concepts associated with solid fuel fires and relate them to PFF activities (def. /off strategies). -Take home exam II covering chapters 5-8+
9		Ch. 9: Heat Release Rate.	Methods of determining HRR, HRR of common materials, Practical application of HRR information.	GPM does not equal BTU. What does the FSP need to know about HRR and Why?	-Take Home Exam II -Ch. 9 PC-NTG -part 1 of research due (technical parts of research due: title page, index, bibliography, appendix)	-Review Exam II (Q&A) -daily quiz-8 -Ch. 9 IC-NTG -know, understand and be able to apply concepts associated with HRR as it relates to the fire service.
10		Ch. 10: Heat Transfer	Review of FFI/FFII Concepts associated with heat transfer.	How is heat transferred, why is this important for the FSP to know? How is this information used?	-Ch. 10 PC-NTG -part 2 of research due (Introduction)	-daily quiz-9 -Ch. 10 IC-NTG -analysis of heat transfer with a focus on understanding applications of information.
11		Ch., 11 IGNITION	-Sources of ignition with statistics -Ignition energy -Material properties that enhance/delay ignition -Ignition calculations -Ignition/flammability testing -Spontaneous ignition	-How does the understanding of ignition enhance the effectiveness of the FSP? Why does stuff burn?	-Ch. 11 PC-NTG - part 8 of research due (Conclusion)	-daily quiz-10 Ch. 11 IC-NTG -understand ignition and its related concepts -analysis of ignition data -make connections to this information and FSP activities -apply this information to discuss current and future trends. -Take home exam covering chapters 9-11+.
12		Ch. 12. Enclosure Fire Modeling	-Growth -fuel controlled VS vent controlled -effects of changing ventilation -Flashover, backdraft, rollover/flameover	How does fire behave in an enclosed environment? What changes fire in the enclosed environment? What does the FSP need to know about enclosed fires/	-Take Home exam III covering chapters 9-11 -Ch. 12 PC-0NTG	-Review Take home exam III covering chapters 9-11 (Q&A) -daily quiz-11 Ch. 12 IC-NTG -compare and contrast effects of independent variables on enclosed fires. -demonstrate understanding of how this information is applied by the FSP -Research case studies where these behaviors were documented.
13		Ch. 13 Fire Modeling	-History of modeling -Types of models -data needed for effective modeling -modeling validation and verification	-Why do FSP conduct fire modeling activities? -How does the FSP utilize fire modeling -what has been modeled? What will be modeled?	-Ch. 13 PC-NTG -rough draft of entire research project due (all but the actual digital presentation with self-assessment sheet)	-daily quiz-12 Ch. 13 IC-NTG -know the history of fire modeling -understand types of data needed -compare and contrast different models -apply modeling to the SMCC Fire Science community fire protection model.

14		<b>Ch. 14: Extinguishment</b>	-theories and methodologies associated with the extinguishment of fire -special look at class D fires -interrupting the chemical chain reaction	-What does the FSP need to know about extinguishment? -How is the method of extinguishment determined?	Ch. 14 PC-NTG	-daily quiz-13 Ch. 14 IC-NTG -know the different theories and methods associated with fire extinguishment -compare contrast methodologies -determine appropriate methodologies based on given scenarios -Take Home Final due Covering chapters 12-14+
15 & 16		<b>Research Presentations 5 min with 2.5 min Q&amp;A</b>			-Final exam (IV) -PPT or other digital medium presentation. -Handouts for all members -complete research due in 3 ring binder -digital presentation sent to instructor before class begins.	-Review final exam (IV) Q & A.

contribute positively to discussions and other class activities. The participation and reflections will be graded based on the quality of participation, ideas, insights, and learned outcome demonstrations, not just the quantity. Missing 2 or more classes can be grounds for failing this course. Tardiness and leaving class early will be subject to daily point deduction and will impact your final course grade. Missing a portion of class will be measured as ½ an absence. (See Classroom Behavior & Expectations). **If a Thursday class is cancelled, due to weather or other event, students will be responsible for checking their e-mail for expectations and instructions.**

### End of Course Evaluations

Students complete evaluations for each course attended at SMCC. Evaluations are submitted online and can be accessed through the student portal. Students can access the course evaluations beginning one week before the end of classes. The deadline for submission of evaluations occurs Monday at 5 p.m. following the last day of the class. You will receive an e-mail to your student e-mail account when course evaluations are available.

### ADA Syllabus Statement

Southern Maine Community College is an equal opportunity/affirmative action institution and employer. For more information, please call (207) 741-5798. If you have a disabling condition and wish to request accommodations in order to have reasonable access to the programs and services offered by SMCC, you must register with the Disability Services Coordinator, Sandra Lynham, who can be reached at 741-5923. Further information about services for students with disabilities and the accommodation process is available upon request at this number. Course policies about online testing are modified to suit each individual's accommodations.

### **The Learning Commons:**

The library, tutoring and writing centers, and open study space are located on the second floor of South Portland's Campus Center and in the Mid-coast's LL Bean Learning Commons and Health Science Center. Here you can find free academic support through individual and online tutoring, information literacy/research librarians, and professional academic strategy/planning mentoring. There are many desktop and laptop computers as well as printers, reserve textbooks, and other academic tools available for use within the Learning Commons. Services are offered by appointment or as drop-in assistance. To access services, visit My Learning in My Maine Guide. Students consistently report that the Learning Commons is an inviting and friendly place to seek academic support or study. Those who make use of the Learning Commons regularly have been shown to be more likely to succeed—take advantage of this exceptional resource for this, or any of your classes.

### **SMCC Pay-for-Print Policy**

Each semester students receive a \$20 printing credit. The balance resets at the end of the semester and any remaining credits are removed. The College's pay-for-print system monitors printing on all printers (including those in general access labs, library printers, Tutoring Services, Campus Center Lounge and technology labs). Be sure to log OUT of the system when you've finished your printing, to prevent unauthorized access to your account. Students can check the number of pages they have printed by using the Printing Balance tool available on SMCC computers (located in the lower right corner of the screen, near the clock). Departments with work study students who need to print documents for the department should contact the Help Desk at 741-5696 to have a special account set up. To find ways to reduce your printing charges, please go to the IT Help tab on My SMCC. If you have questions about the pay-for-printing policy or your printing charges, please contact the Help Desk at 741-5696 or send an e-mail to [helpdesk@smccme.edu](mailto:helpdesk@smccme.edu).

### **Refunds**

Print jobs are eligible for a refund in the event of mechanical or electronic error on the part of the printer, print server, or software used to submit the job. Jobs are not eligible for a refund in cases where the job was not set up correctly, was submitted multiple times, or the student is not satisfied with the result. To request a refund, please bring the offending print to the IT Department in the basement of the Ross Technology Center. Refunds will be granted in the form of a credit to the student's account.

### **Add-Drop Policy**

Students who drop a course during the one-week "add/drop" period in the fall and spring semesters and the first three days of summer sessions receive a 100% refund of the tuition and associated fees for that course. Please note any course that meets for less than the traditional semester length, i.e., 15 weeks, has a pro-rated add/drop period. There is no refund for non-attendance.

**Withdrawal Policy**

A student may withdraw from a course only during the semester in which s/he is registered for that course. The withdrawal period is the second through twelfth week of the Fall and Spring semesters and the second through ninth week of twelve-week Summer courses. This period is pro-rated for shorter-length courses, usually 75 percent of course meeting times; please check with the Registration Office. To withdraw from a course, a student must complete and submit the appropriate course withdrawal form, available at the Registration Office. This process must be completed either in person or by using SMCC e-mail accounts.

**Plagiarism Statement**

If an instructor suspects that a student has knowingly committed a violation defined in the Maine Community College System Policy on Student Grade Appeals and Academic Misconduct, the instructor has the authority to review the alleged misconduct and determine the grade that the student should receive for the assignment and the course. The instructor may assign a failing grade for the assignment or course and may require the student to complete additional work for the course. The instructor may consult with the department chair and/or the College's chief academic officer prior to making such decisions. If a student seeks to challenge an instructor's determination, the student should submit a grade appeal. Grade appeal forms are available in the Advising Office on the South Portland Campus or in the administrative offices in the Learning Commons on the Midcoast Campus. An instructor may also refer the matter to the College's disciplinary officer for review under the procedures of the MCCS Student Code of Conduct