ME 456/AME 598E–Fundamentals of Combustion
Spring 1996

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Course time and location: MWF 10:10-11:00 AM, 120 DeBartolo

Prerequisites: ME 439 or equivalent

Catalog description

"Thermodynamics and chemical kinetics of combustin reactions, classification and order-of-magnitude analysis of combustion phonomena. Practical applications. Not every year."

Instructor's emphases

This course is designed to give the senior engineering student or first year graduate student a background in combustion theory. The course focuses on the interplay between chemistry and fluid mechanics. In addressing relevant problems, the student will also be introduced to some advanced methods involving non-linear wave mechanics, dynamic system analysis, asymptotic analysis, stability theory, and self-similarity. Specific topics are

- Chemical kinetics
- Governing equations of reactive fluid mechanics
- Detonation theory
- Ignition and stability
- Diffusion flames
- Premixed laminar flames

The course notes will be self-contained and not follow the texts closely; the recommended texts are extensive in scope and are made available for the student who wants supplementary material. The course is open to undergraduates, who have competed very successfully in past years, and graduates. Students taking the course for graduate credit will be assigned additional problems.

Text available in bookstore

Kuo, K. K., *Principles of Combustion*, Wiley: New York, 1986, $115.00 (not required)
Williams, F. A., *Combustion Theory*, Addison-Wesley: New York, 1985, $60.95 (not required)

Texts on reserve in the Engineering Library

Fickett, W., and Davis, W. C., *Detonation*, University California Press: Berkeley, 1979.
Kanury, A. M., *Introduction to Combustion Phenomena*, Gordon and Breach: New York, 1975.

Lewis, B., and von Elbe, G., *Combustion, Flames, and Explosions of Gases*, Academic Press: Orlando, 1987.
Strehlow, R. A., *Combustion Fundamentals*, McGraw-Hill: New York, 1984.
Toong, T.-Y., *Combustion Dynamics: The Dynamics of Chemically Reacting Fluids*, McGraw-Hill: New York, 1983.
Turns, S. R., *An Introduction to Combustion*, McGraw-Hill: New York, 1996, ISBN 0-07-911812-7.

Required Work and Grading

There will be two hour exams and a comprehensive final exam.

Homework will be assigned regularly from the text and other sources. All homework will be graded and returned. Homework must be done on *one side only* of 8 1/2" by 11" *engineering* paper with no frayed edges. Multiple pages must be stapled. You should briefly restate the problem, give a sketch if helpful, give all necessary analysis, and place a box around your final answer. Correct units must always accompany numerical answers. Neatness and effective communication are considered in grading as well as numercial answers. Also two short journal reviews will be required.

Two short (two page maximum) summaries of works from the literature will be required, one from Combustion and Flame and the second on a paper dealing with combustion in the Journal of Fluid Mechanics. Your review should 1) summarize the article's major findings and 2) offer an argument why this paper is deserving of recognition. In addition you should have a working knowledge of the details of the paper. The review must use the TeX word processer.

Grades will be assigned based on students' performance on examinations, homework, and papers. The weights assigned to each are as follows:

Exam I	20	Friday, 23 February 1996
Exam II	20	Friday, 12 April 1996
Final Exam	35	Tuesday, 7 May 1996, 8:00-10:00 AM
Homework	20	
Reviews	5	Friday, 16 February 1996; Friday, 29 March 1996
Total	**100**	

A university-approved excuse must be provided in case of absence during a quiz or examination. All work must be completed to receive a passing grade.

Honesty Policy

Academic honesty is expected. When confronted with an apparant violation, I will enforce the honor code to the best of my ability. I will also try to make my expectations clear. By and large, though, these issues are out of my control and as such I do not seek out violations. Instead, I depend upon your basic integrety to prevent any problems.

In brief my expectations are as follows. I encourage you to freely discuss the homework amongst one another as you formulate your solutions *individually*. *Your* written work should represent *your* understanding of the problem. In practice this means copying (in whole or in part) another student's homework, exam, computer program, or paper is *not* permitted. If you choose to discuss your work with a colleague, it should be a discussion in which one teaches another or both work to a mutual understanding. As a counter-example, it is not acceptable to give a friend your homework five minutes before class so that friend can copy your work. I also consider it unacceptable to copy work from a student who was in the class in a previous year. In your written reports, be careful to correctly use quotation marks for words that did not originate with you. Also be sure to properly cite all sources you used. As is done in the scientific literature, you should *briefly* acknowledge in writing any significant discussions or interactions you had regarding the work you submit. As a general principle, I do not accept the justification that you were not sure of my intentions. If you feel you may be in an ethical grey area, then you should consult with me *before* acting.