

**ME 456–Fundamentals of Combustion  
Spring 1999**

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Office hours: when available

Course web page: <http://www.nd.edu/~powers/me.456>

Course time and location: MWF, 10:40-11:30 AM, 117 DeBartolo

Prerequisites: ME 439 or equivalent

Catalog description

“Thermodynamics and chemical kinetics of combustion reactions, modeling of reacting fluid mechanical systems, subsonic and supersonic combustion, detailed and one-step kinetics, ignition theory, asymptotic and numerical techniques for modeling combustion systems. Not every year.”

Instructor’s emphases

This course is designed to give the 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.

Text available in bookstore

Warnatz, J., Maas, U., and Dibble, R. W., *Combustion: Physical and Chemical Fundamentals, Modelling and Simulation, Experiments, Pollutant Formation*, Springer: Berlin, 1996.

Texts on reserve in the Engineering Library

Williams, F. A., *Combustion Theory*, Addison-Wesley: New York, 1985, \$60.95 (not required)

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.  
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 numerical answers.

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, 19 February 1999
Exam II	20	Friday, 9 April 1999
Final Exam	35	Wednesday, 5 May 1999, 8:00-10:00 AM
Homework	25	
<b>Total</b>	<b>100</b>	

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 apparent 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 integrity 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.