University Of California, Berkeley
Department of Mechanical Engineering

ME 256 -- Combustion (3 Units)

Graduate Course

Syllabus

CATALOG DESCRIPTION

Combustion modeling. Multicomponent conservation equations with reactions. Laminar and turbulent deflagrations. Rankine-Hugoniot relations. Diffusion flames. Boundary layer combustion, ignition, and stability.

COURSE PREREQUISITES

ME 40, ME 106, and ME 109 (106 and 109 may be taken concurrently) or their equivalents. ME 140/ME255 is recommended.

TEXTBOOK(S) AND/OR OTHER REQUIRED MATERIAL

Sample:

Warnatz, J, Maas, U., Dibble, R.W., 6-th ed. “Combustion”, Springer, 2013

Other Useful Reference Textbooks:
Glassman, I. Combustion Academic Press, 3rd Edition, 1996.
Kuo, K, K, *Principles of combustion*, Wiley, 1986.
Williams, F.A. Combustion Theory, 2nd ed. Benjamin/Cummins, 1985.
Turns, S.R. *An Introduction to Combustion*, McGraw Hill, 2ndEdition,1996.

COURSE OBJECTIVES

This course provides students a solid foundation in combustion sciences and technologies relevant to current and future energy conversion devices using combustion.

DESIRED COURSE OUTCOMES

Students will have the ability to perform critical analyses of current and future reacting systems using analytical and numerical methods. For practical combustion systems with complex geometries, students will have gained sufficient background to further their capabilities of using advanced numerical models.

TOPICS COVERED

Topics include: Review of thermochemistry, Chemical Kinetics (explosion limits, negative temperature dependence, NOx formation), Conservation Equations for Reacting Flows, Computer modeling of combustion processes, Premixed flames (deflagration and detonation), and Nonpremixed flames. Applications using advanced combustion systems for energy efficiency and low emissions will be discussed.

CLASS/LABORATORY SCHEDULE

3 hours of lecture and 0-1 hour of discussion. (Variable).

CONTRIBUTION OF THE COURSE TO MEETING THE PROFESSIONAL COMPONENT

To provide essential knowledge of combustion theory and models for practical designs of reacting systems.

ASSESSMENT OF STUDENT PROGRESS TOWARD COURSE OBJECTIVES

1) Homework (30%)
2) Midterm (30%):
3) Final (40%)

TOPICS COVERED/WEEKLY AGENDA

Sample

Topic Text Ref.	(Warnatz 6th edition)
Introduction, Fundamental Definitions	Chap. 1
Experimental Investigation of flames	Chap. 2
Review of Thermodynamics	Chap. 4
Chemkin (Computer modeling)	Handout
Chemical Kinetics, Reaction Mechanisms	Chaps. 6, 7
Chemkin Applications	Chaps. 6, 7, 8
H2-O2 Combustion /Explosion Limits	Chap. 10
CH4 Oxidation	Chap. 7
Combustion of higher hydrocarbon fuels	Chaps. 10,11
Detonation	Chap. 10
Transport Phenomena /Conservation Equations	Chaps. 5,12
Laminar premixed flames	Chaps. 3 ,8
Laminar Nonpremixed Flames	Chap. 9
Opposed jet flames: computer modeling	Handouts
Turbulent Combustion	Chaps 14 & 15
Emission from combustion Nitric Oxides	Chap. 17

Assignments:
Homework, Computer projects using computer programs (Chemkin or Cantera)

PERSON(S) WHO PREPARED THIS DESCRIPTION
Professor Jyh-Yuan Chan, Oct 1st, 2015

ABBREVIATED TRANSCRIPT TITLE (19 SPACES MAXIMUM):
TIE CODE: [Shareena Enters]
GRADING: Letter and/or Pass Not Pass

SEMESTER OFFERED: Fall and Spring
COURSES THAT WILL RESTRICT CREDIT: None
INSTRUCTORS: Staff
DURATION OF COURSE:
EST. TOTAL NUMBER OF REQUIRED HRS OF STUDENT WORK PER WEEK:
IS COURSE REPEATABLE FOR CREDIT?
CROSSLIST: None