

Faculty of Engineering, Architecture and Science
Department of Mechanical and Industrial Engineering

Course Outline (W2013)

MEC 817: Combustion Engineering

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Prerequisites: MEC 514, MEC 516, MEC 701, PCS 213, CMN 432, ECN 801, MEC 309, MEC 411, MEC 430, MEC 431, and MTH 510

Compulsory Texts: Stephen R. Turns, *An Introduction to Combustion: Concepts and Applications*, McGraw-Hill, 2000

Calendar Description: This course will cover combustion fundamentals and their application to engineered combustion systems such as furnaces and fossil-fuelled engines, with an emphasis on maximizing combustion efficiency and minimizing pollutant formation. Topics covered will include flame stoichiometry, chemical kinetics, flame temperature, pre-mixed and diffusion flames, fuel properties, continuous and unsteady combustion systems, pollution reduction techniques and safety issues.

Learning Objectives:

At the end of this course, the successful student will have demonstrated that s/he:

1. Uses judgment in solving problems with uncertainty and imprecise information (2a)
2. Generates solutions for more complex design engineering problems/systems (4d)
3. Writes and revises documents using appropriate discipline specific conventions (7a)
4. Adapts format, content, organization, and tone for various audiences (7a)
5. Demonstrates accurate use of technical vocabulary (7a)
6. Knows regulations governing professional practice (8c)
7. Considers economic, social and environmental factors in decisions (9a)

Note: Numbers in parentheses refer to the graduate attributes required by the Canadian Engineering Accreditation Board. For more information, see:

<http://ryerson.ca/feas/programs/qa/gradattributes.html>

Course Organization: 3 hours of lecture per week for 13 weeks, in 1 section
1 Teaching Assistant, 1 section per TA

Course Evaluation:	Assignments	20%
	Midterm Exam	30%
	<u>Final Exam</u>	<u>50%</u>
	Total	100%

There will be four assignments of equal value, one midterm and one final exam. **Late submission of assignments will be penalized 10% per day.** The work you submit must be your own. You may consult with your peers, but you may not examine their work and you may not provide your work to another student to be examined.

Examinations:

Midterm exam, during class, two hours, closed-book (covers weeks 1 – 6)

Final exam, during exam period, three hours, closed-book (covers weeks 1 – 13)

Course Content:

1. **Introduction and Motivation** (~1 lecture)
2. **Fundamentals:** (~4 lectures) conservation of mass, stoichiometry, equivalence ratio, conservation of energy, heat of combustion, heating value, adiabatic flame temperature
3. **Burning Fuels:** (~15 lectures) gaseous fuels, chemical equilibrium, pressure effects, practical fuels, solid fuels, chemical kinetics, hydrocarbon mechanisms, NO_x formation, liquid fuels
4. **Flames:** (~17 lectures) premixed flames, diffusion flames, flame stabilization, well stirred reactor, blowout limits, ignition, emissions, droplet evaporation and burning

E-mail: Most communications with the class will be done via e-mail. It is the student's responsibility to activate their Ryerson e-mail account and check it regularly.