## Syllabus

Class Meeting: MWF (10:00-10:50 am)
ENG B2

Instructor: Dr. Bret C. Windom
Office: ENG A103T
Phone: 970-491-7794
Email: bret.windom@colostate.edu

Textbook: <u>An Introduction to Combustion: Concepts and Applications</u>, Stephen R. Turns, Third Edition, McGraw Hill, 2011.

Office Hours: Monday, Wednesday, and Friday 11:00am –1:00 pm (or email me to make an appointment)

Teaching Assistant: TBD
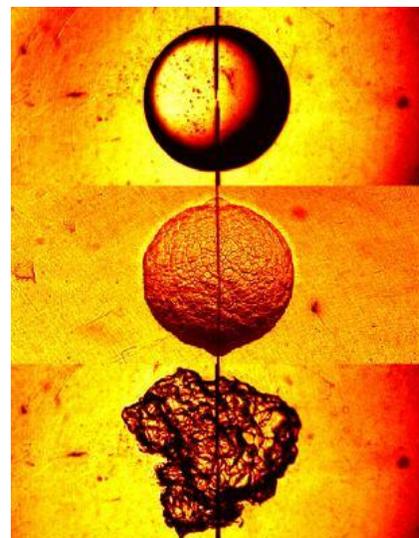
Princeton – CK Law

Technical Objectives: Combustion refers to the study of chemically reacting fluid systems. Thus, this course utilizes all of the fundamental tools acquired during the study of Chemistry, Thermodynamics, Heat Transfer, and Fluid Mechanics. Upon completion of this course, each student will be able to:

- *Calculate* adiabatic flame temperatures using the concepts of chemical equilibrium.

- *Predict* how equilibrium composition will shift with varying pressure and temperature.

- *Derive* the Arrhenius rate expression from simple kinetic theory.

- *Explain* the explosion limits of the H_2/O_2 system using chemical kinetic arguments.

- *Explain* qualitatively the chemical oxidation mechanism of alcohols, alkanes and aromatics, and *explain* the NTC region in alkane oxidation via elementary chemical kinetic arguments.

- *Assemble* detailed chemical kinetic mechanisms and *model* zero and one-dimensional chemically reacting systems using reaction design software.

- *Calculate* premixed laminar flame speed using phenomenological arguments and *perform* complex laminar flame calculations using reaction design software.

- *Determine* the burning rate of a liquid fuel droplet.

- *Explain* the formation mechanisms of NO_x, HC, CO and PM in combustion systems and how to design systems with low pollutant formation.

Grading Policy:

Homework and Class Participation (30%). Homework will be assigned on a periodic basis. Homework assignments will be in the form of problems or short projects.

Research Paper (10%). Research paper covering a topic of your choice. Paper will incorporate concepts from class and how they relate to application and a real world problem.

Midterm Exam (30%). A written midterm exam will be given approximately half-way through the semester

Final Exam (30%). A comprehensive written (maybe oral – we'll see) final exam will be given during the final exam week.

Attendance Policy and Rules

Attendance at each class is required. Class participation is a key component of the course. Notebooks and calculators should be brought to each class. Cell phones must be turned off, unless you have an emergency situation then please set to vibrate.

Information

Information on this class (including this syllabus) will be posted on the class **Canvas** site.

Course Outline

Week	Date(s)	Text	Topics
1	Aug. 26	Ch. 1 Ch. 2	Course Overview; Combustion Terminology and Gas Mixtures
2	Sept. 3	Ch. 2	Calculation of adiabatic flame temperature; Chemical equilibrium.
2	Sept. 9	Ch. 2	Chemical equilibrium; Calculation of adiabatic flame temperature using STANJAN and Chemkin
3	Sept. 16	Ch. 4	Introduction to Chemical kinetics. Global vs. elementary reactions. Derivation of Arrhenius rate expression from kinetic theory. Chain reactions.
4	Sept. 23	Ch. 5	Hydrogen- Oxygen explosion limits. Chain branching. Carbon Monoxide Explosion Limits.
5	Sept. 30	Ch. 5 App. 2A	Nomenclature in Organic Chemistry Oxidation characteristics of hydrocarbons: alcohols, alkanes, aromatics.
6	Oct. 7	Ch. 6 /Ch. 7	Coupling Chemical and Thermal Analysis of Reacting Systems Transient homogeneous H_2/O_2 calculations
7	Oct. 14	Ch. 3	Mass Transfer
8	Oct. 21		Midterm; Monday 10/21, Material: TBA
9	Oct. 28	Ch. 8	Premixed Laminar Flames
10	Nov. 4	Ch. 8	Premixed Laminar Flames
11	Nov. 11	Ch. 8	Modeling of Premixed Laminar Flames
12	Nov. 18	Ch. 9	Laminar Diffusion Flames
13	Nov. 25		No class: Thanksgiving
14	Dec. 2	Ch. 10	Droplet Evaporation and Combustion
15	Dec. 9	Ch. 15	Environmental Considerations: Smog, Oxides of Nitrogen (NO_x), Particulate Matter
16	Dec. 20		Final Exam - Friday Dec. 20 (7:30a-9:30a)

<u>Course Policies</u>

<u>Academic Integrity</u>

- The instructor reserves all right and judgment regarding incidents involving academic integrity.
- The following website contains information from Colorado State University regarding Student Codes of Conduct and Academic Dishonesty. As a student in this course, you are held to the Student Codes of Conduct and the Academic Dishonesty clauses. You should become familiar with the information contained on the CSU website regarding these issues.

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http://resolutioncenter.colostate.edu/conduct-code/

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<u>Coursework</u>

- <u>Assignments are to be turned in at the beginning of the class period they are due. It is considered late and will not be accepted, resulting in a **zero** for the assignment, if submitted after I collect the assignments at the beginning of class</u>.
- Homework solutions must follow the specified format discussed in class. Problem solutions which do not follow the format and/or are illegible or difficult to read will not be graded and will be given a zero.
- All assignments are posted on *Canvas*. The homework assignment and due date will be posted under the "Assignments" tab.
- You are allowed to discuss **qualitatively** with other students the concepts required to solve homework problems.

However, copying or in any way using the written work of another person as well as relaying or receiving solutions via any means (including solutions manuals) is strictly prohibited and considered cheating.

- The intent of this policy is to allow you to share ideas, discuss concepts, and clarify processes when needed. This policy requires you to **independently** prepare the detailed solution to homework problems.
- Quizzes, Projects, and Exams are to be **INDIVIDUAL EFFORT** and **NO COLLABORATION** is acceptable.
- **In general, no late homework or Exams will be accepted**.
    - The exam dates are set and given in the course outline. If you expect to miss an exam, you must notify me **As Soon As Possible.** If you do not notify me before the exam and we have not developed an alternative plan, you will receive a zero on the exam.
    - If you will be absent the day an assignment is due it is your responsibility to notify me and make arrangements to turn in the assignment before class.
    - I will accept electronic submissions for assignments as long as the email is received before the start of class.

Cheating Policy

- Students caught using other students' material, or using material not their own (this includes, but not limited to, the use of solutions manuals, copying from your peers on exams or homework assignments, using prohibited materials on exams, and plagiarism on written assignments) will receive an **"AIF"** for **failing the course due to academic integrity**. **This is your only warning.**

Disability Services

- If you are a student with a disability and believe you will need accommodations for this class, it is your responsibility to contact and register with the Disability Services Office, and provide them with documentation of your disability, so they can determine what accommodations are appropriate for your situation. To avoid any delay in the receipt of accommodations, you should contact the Disability Services Office as soon as possible. Please note that accommodations are not retroactive, and that disability accommodations cannot provided until an accommodation letter has been given to me. Please contact Disability Services for more information about receiving accommodations at the General Services Building room 100, 970-491-6385 or Rose.Kreston@colostate.edu.

Dropping the Course
- Last day to withdraw from course is October 21, 2019 (https://registrar.colostate.edu/faculty-staff/important-dates/)

Classroom Etiquette
- Students may not listen to any electronic device or answer their cell phone in class. If you need to answer an important call or text, please leave the room. Disruptive students will be asked to leave for the remainder of class, will not be able to make up missed material, and will be required to meet with the Dept. Head.

* The information herein is subject to change at the discretion of the instructor.