

# Sample Syllabus

## ME 430 / EGEE 430 INTRODUCTION TO COMBUSTION

Fall 2024

Canvas: ME/EGEE 430 Fall 2024 merged

**Please note that the specifics of this Course Syllabus can be changed at any time, and you will be responsible for abiding by any such changes. All changes will be communicated to you via e-mail, course announcement and/or course discussion forum.**

Class Meetings            12:20 – 1:10 PM MWF, Henderson Bldg 117

Instructor                Dr. Richard Yetter  
104 Research East Building, 814 863-6375  
[ray8@psu.edu](mailto:ray8@psu.edu) – email is the best way to contact the instructor.

Teaching Assistant/ Grading Assistant: Unknown currently

Office Hours             MW 4:30pm-5:30pm (Yetter)

Textbook                 Turns and Haworth, *An Introduction to Combustion: Concepts and Applications*, 4th edition, McGraw Hill, 2021. Earlier editions can be used.

Grading                 Assignments (~9)            1/3  
                                  Quizzes (~4)                1/3  
                                  Exams (2)                    1/3

The following cutoffs normally are used to map from percentage to final course letter grade. The instructor may lower the cutoffs, depending on class performance, but will not raise them:

≥93 A; ≥90 A-; ≥87 B+; ≥83 B; ≥80 B-; ≥77 C+; ≥70 C; ≥65 D; <65 F

Objectives                The objectives of this course are:

- 1) To integrate core undergraduate ME/EGEE/ChemE subjects (physical chemistry, engineering mathematics, thermodynamics, heat and mass transfer, fluid mechanics) into a coherent introductory treatment of combustion.
- 2) To prepare the student for professional practice and/or further study in the field. At the end of this course, the student should be able to analyze and design basic reacting hydrocarbon-air systems for performance, energy efficiency, and pollutant emissions.
- 3) Demonstrate professionalism in interactions with colleagues, faculty, and staff.

Course Outline  
(Abbreviated)

1. Introduction – Chs. 1,17
  - I. Motivation
  - II. Elements of combustion
  - III. Fuels

2. Combustion Thermochemistry – Ch. 2
  - I. Thermodynamics review
  - II. Stoichiometry
  - III. First-law concepts
  - IV. Second-law concepts
3. Chemical Kinetics – Chs. 4,5
  - I. Elementary reactions
  - II. Multistep elementary reaction mechanisms
  - III. Elementary and global hydrocarbon-air reaction mechanisms

----- *~halfway through the semester* -----
4. Homogeneous Systems – Ch. 6
  - I. Constant-pressure and constant-volume reactors
  - II. Well-stirred reactor
5. Transport Properties and 1D Flame Equations – Chs. 3,7
  - I. Molecular transport properties
  - II. Conservation equations for steady 1D planar configurations
  - III. Mixture fractions
6. Laminar Flames – Chs. 8,9
  - I. Laminar premixed flames
  - II. Laminar diffusion (nonpremixed) flames
7. Turbulent Flames – Chs. 11,12,13
  - I. Turbulence
  - II. Premixed turbulent flames
  - III. Nonpremixed turbulent flames
8. Pollutant Emissions and Low-Carbon Combustion – Chs. 15,18
  - I. Pollutant formation mechanisms and mitigation strategies
  - II. Low-carbon-intensity combustion

**Textbook Reading**      At the start of each section of course material, the instructor will point out which sections of each chapter will be covered. We will not cover everything that is in each chapter, and the instructor will sometimes introduce material to supplement the textbook. Students are expected to keep up with the reading through the semester. It should be clear from the in-class coverage and assignments what material the students are expected to know (e.g., for quizzes and exams).

**Mode of Operation**      Canvas will be the principal means for distributing course material and information, and for collecting all graded student assessments (homework assignments, quizzes, and exams when appropriate). Students should check the Canvas course site regularly. All course materials can be accessed from the Modules tab. The material is organized sequentially for the full semester, including homework assignment and quiz dates. The instructor will use Canvas email to send course information to students. It is recommended that students configure their Canvas email to forward that to the email address that they prefer to use.

**HW Assignments**      Students are encouraged to discuss assignments with one another, to the extent that they find that to be beneficial. However, each student is to turn in an

individual solution that represents primarily their own effort. Each student is to upload their solution to Canvas by the end of the day (11:59 PM U.S. Eastern Time) on the specified due date. Do not wait until the last minute to upload your solution. Late assignments will not be accepted unless prior arrangements have been made with the instructor. The instructor may allow one exception to the late submission policy per student per semester, with a satisfactory explanation. See Guidelines for Graded Submissions posted on the Canvas webpage for the required formatting.

Quizzes & Exams      Quizzes and exams will be open book/open notes and will be administered via Canvas. **Each student is expected to work independently.** For each quiz and exam, every student will be required to certify that they did not receive any assistance from anyone else and did not provide assistance to anyone else. See Academic Integrity below. See Guidelines for Graded Submissions posted on the Canvas webpage for the required formatting.

Mask Policy            Students will be required to comply with current University policy. There may be changes in policy as the semester progresses. See <https://virusinfo.psu.edu> for the latest information.

Accommodations      Penn State welcomes students with disabilities into the University's educational programs. Every Penn State campus has an office for students with disabilities. The Student Disability Resources (SDR) website provides contact information for every Penn State campus: <http://equity.psu.edu/sdr/> disability-coordinator. For further information, visit the Student Disability Resources website at <http://equity.psu.edu/sdr/> and <http://equity.psu.edu/ods/considering-penn-state/reasonable-accommodations> .

To receive consideration for reasonable accommodations, you must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation; see the documentation guidelines at <http://equity.psu.edu/sdr/guidelines> . If the documentation supports your request for reasonable accommodations, your campus disability services office will provide you with an accommodation letter. Please share this letter with your instructors and discuss the accommodations with them as early in the semester as possible. You must follow this process for every semester that you request accommodations.

Academic Integrity    Academic integrity is the pursuit of scholarly activity in an open, honest and responsible manner. Academic integrity is a basic guiding principle for all academic activity at The Pennsylvania State University, and all members of the University community are expected to act in accordance with this principle. Consistent with this expectation, the University's Code of Conduct states that all students should act with personal integrity, respect other students' dignity, rights and property, and help create and maintain an environment in which all can succeed through the fruits of their efforts.

Academic integrity includes a commitment by all members of the University community not to engage in or tolerate acts of falsification, misrepresentation or deception. Such acts of dishonesty violate the fundamental ethical principles of the University community and compromise the worth of work completed by others.

In this course, students are encouraged to discuss assignments with one another, to the extent that they find that to be beneficial – but each student is to turn in an individual solution that represents primarily their own effort. Quizzes and exams are to be individual efforts. Failure to abide by these rules, or the commission of any other deliberately dishonest act, may result in failure of the course with no late drop permitted. Examples of acts that would be considered as academic misconduct include posting of course materials online, or getting help from, or giving help to, another student on a quiz or exam. See <https://undergrad.psu.edu/aappm/G-9-academic-integrity.html> .

#### Counseling

Many students at Penn State face personal challenges or have psychological needs that may interfere with their academic progress, social development, or emotional wellbeing. The university offers a variety of confidential services to help you through difficult times, including individual and group counseling, crisis intervention, consultations, online chats, and mental health screenings. These services are provided by staff who welcome all students and embrace a philosophy respectful of clients' cultural and religious backgrounds, and sensitive to differences in race, ability, gender identity and sexual orientation.

Counseling and Psychological Services at University Park (CAPS): <http://studentaffairs.psu.edu/counseling/> 814-863-0395

Counseling and Psychological Services at Commonwealth Campuses: <https://senate.psu.edu/faculty/counseling-services-at-commonwealth-campuses/>

Penn State Crisis Line (24 hours/7 days/week): 877-229-6400 Crisis Text Line (24 hours/7 days/week): Text LIONS to 741741

#### Educational Equity

Penn State takes great pride to foster a diverse and inclusive environment for students, faculty, and staff. Acts of intolerance, discrimination, or harassment due to age, ancestry, color, disability, gender, gender identity, national origin, race, religious belief, sexual orientation, or veteran status are not tolerated and can be reported through Educational Equity via the Report Bias webpage: <http://equity.psu.edu/reportbias/> .

#### Recording Notice

Video and audio recordings of class lectures may be part of the classroom activity. The video and audio recording are used for educational use/purposes and may be made available to all students presently enrolled in the class. For purposes where the recordings will be used in future class session/lectures, the videos will adequately remove any type of student identifying information.