

# ME 460: Fuels and Combustion

## Course Outline and Objectives

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**Institution:** South Dakota School of Mines and Technology, Rapid City, SD

**Location and Time:** see <https://www.sdsmt.edu/>

**Instructor:** D. Lewis Abata, Professor of Mechanical Engineering, Rm. CM125

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**Website:** <http://abata.sdsmt.edu>

**Office Phone:** 605-394-6070

**Office hours:** Posted on the website.

### Texts:

Ragland, K., and K. Bryden, Combustion Engineering, Second Edition, CRC Press, Taylor and Francis Group, ISBN 978-1-4200-9250-9, 2011.

Introduction to Thermodynamics 1 and 2, Properties Booklet, McGraw-Hill Create Series.

**Purpose:** (3-0) 3 credits. Prerequisites ME 312, ME 313, ME 331. This course provides an introductory treatment of fuels and combustion science. The objectives of the course are to develop an understanding of hydrocarbon fuels, combustion reactions and kinetics, flame dynamics, flame stability, and pollutant formation. Coverage includes laminar and turbulent flames, premixed and diffusion flames, and detonations. Fundamental aspects of combustion are applied to analysis of the combustion process and pollutant formation in internal combustion engines and other combustors

### Course Objectives:

This course provides an introductory treatment of fuels and combustion science. The objectives of the course are to develop an understanding of hydrocarbon fuels, combustion reactions and kinetics, flame dynamics, flame stability, and pollutant formation. Coverage includes origin of fossil fuels, basic concepts, combustion of gaseous fuels, combustion of liquid fuels, and combustion of solid fuels.

1. Understanding of fuel origins and basic fuel chemistry (organic chemistry)
2. Understanding of combustion fundamentals and basic chemical kinetics
3. Understanding of applied combustion systems such as gaseous, liquid, and solid fuel heaters, furnaces, and boilers.
4. Apply basic concepts of combustion to engineering processes

### Technology skills:

Students are expected to have writing skills so that their work can be read by the instructor. Students are also expected to have computer skills and be able to work with spreadsheet software, word processing software, and programming in C++.

## Lectures, Questions, and Homework Problems:

1. Since you have a text for the course and a well defined reading schedule (see course syllabus) you are expected to read the material thoroughly and take notes on what you read before each class. If you do not understand a particular point or are confused in any way, you are expected to ask questions during class. If you have a question and are afraid to ask, there are probably several other students with the same question. Remember no question is too simple or too foolish to ask.
2. Lectures will not duplicate word for word what is in the text. You will be expected to do the assigned problems and have these problems completed before the beginning of class.
3. You may stop in and see me during my office hours which are posted on my website (listed at the top of this page).
4. Homework problems will be randomly collected throughout the term. Homework must be legible. Homework must be done on engineering graph paper (light green in color). Your name must be printed on the upper right corner. The date you completed the homework must be printed below your name. The course number 'ME460' must be printed on the upper left corner. The problem number must be underlined or circled, and on the left margin. Each problem should begin on a new page unless the problem is overly simplistic. Problems must be done in pencil. Homework problems of course must be neat and readable. No credit will be given for problems that do not follow the above format and are not readable. Keep all of your problems together preferably in a 3-ring binder as the homework that is collected on a particular day may have been assigned on an earlier day. Late homework will not be accepted. If you plan to be absent from class you must hand in your homework the lecture before you are absent from class. It is not difficult to figure out how important homework is in this class, both for comprehension of subject matter and final grade.
5. Late homework will not be accepted. If you plan to be absent from class you must have your homework checked before the lecture you are absent from class.

## Course Grade:

The grade earned by the student will be based upon the following (tentative) percentages:

|                               |      |
|-------------------------------|------|
| Exams and Quizzes             | 60%  |
| Final Exam                    | 30%  |
| Homework, Class Participation | 10%  |
| Total                         | 100% |

A design component may be added depending upon the syllabus. Generally the design component is 10-20% and the exams/quizzes and final exam components are lowered accordingly to total 100%. I reserve the right to modify the course outline and percentages during the course.

The following nominal grade distribution can be used as a guideline to determine relative ranking:

A = 94-100; B = 86-93; C = 72-85; D = 65-71, F = Below 65%

As in all classes at in higher learning issuing a final grade for a course is the right and responsibility of the instructor. Please don't argue about the final grade unless there is a clear and obvious error.

**Attendance Policy:** Students are expected to attend class regularly. Attendance is not required however you should alert the instructor if you plan to miss several days at any one time. Attendance will not be taken regularly. Quizzes and exams are announced ahead of the event. It is up to the student to determine when and where quizzes and exams will be conducted. Thus, reasonable attendance is necessary to keep up in class and know when quizzes and exams will occur.

**Make-Up Policy:**

Missed quizzes and exams can be taken at a different time only if the instructor is alerted one (1) week before the scheduled date of the quiz/exam or, in the case of illness or other medical reason deemed appropriate by the instructor, a simple email before the exam is sent to the instructor. Emergency situations will be dealt with on a case by case basis.

**Electronic Devices Policy:**

Please turn off your cell phone before class starts. No text messaging in class. No headphones. Web browsing, game playing, social networking, including sending/reading e-mail, is prohibited during the lecture period. If you wish to do any of the above please leave the room. No other use of any other electronic/computer media is allowed during class time.

**Freedom in Teaching/Freedom in Learning Statement:**

Under Board of Regents and University policy student academic performance may be evaluated solely on an academic basis, not on opinions or conduct in matters unrelated to academic standards. Students should be free to take reasoned exception to the data or views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled. Students who believe that an academic evaluation reflects prejudiced or capricious consideration of student opinions or conduct unrelated to academic standards should contact the Provost and Vice President for Academic Affairs to initiate a review of the evaluation.

**ADA & Additional Comments:**

1. SD Mines strives to ensure that physical resources, as well as information and communication technologies, are accessible to users in order to provide equal access to all. If you encounter any accessibility issues, you are encouraged to immediately contact the instructor of the course and the Title IX and Disability Coordinator, Ms. Amanda Lopez at [disabilityservices@sdsmt.edu](mailto:disabilityservices@sdsmt.edu) or 394-2533. Students with special needs or requiring special accommodations should also contact the instructor and the Title IX and Disability Coordinator. More information can be found at <https://www.sdsmt.edu/Campus-Life/Student-Support/Disability-Services/>
2. Students with special needs or requiring special accommodations should contact the instructor, and/or the campus ADA coordinator, at 394-1924 at the earliest opportunity. These students must contact me one week before each examination if special needs are to be requested.
3. I strongly support CAMP (Center for Advanced Manufacturing and Processing) activities such as the Formula Car, Baja Vehicle, Aero Team, etc. However CAMP activities are to augment your academic experience rather than replace it. Please do not confuse your priorities. Adjustments (schedule changes, exam dates, homework assignments, etc.) to this class will not be made for CAMP activities.

4. Cheating is not allowed in any shape or form. Students who cheat will be immediately reported to the SDSMT Dean of Students. Cheating takes many forms such as copying the work of others, copying solutions from the Internet, looking at the answers or solutions of others during a quiz or examination, or having written or stored information not available to other students during a quiz or exam. Written information may take the form of a note, a 'cheat sheet,' that written on one's hand, arm, etc. Stored information may take the form of that stored electronically or otherwise in a computer, calculator, mobile phone, etc. These examples of cheating discussed in this paragraph are not inclusive. Stated another way, cheating has occurred if you have information that other classmates do not have during an exam, quiz or when completing a homework assignment.

SDBOR Policy 2:33 defines "Academic Misconduct" at length, but it all comes down to cheating, plagiarizing, falsifying, copying, misrepresenting, 'borrowing' ideas or information, or helping someone else do any of these things: 1) stay far clear of anything that even *resembles* any of the actions listed above; 2) it's OK to say "NO" if someone presses for 'sharing' or 'borrowing' work. Saying "No" is deemed rude by some; it isn't. Cheating is so very tempting when deadlines loom and work piles up; however, the person being cheated is the student him or herself. Moreover, the damage extends to all classmates; and 3) I am obligated to report dishonesty, and the processes described in the Student Code of Conduct.

5. You must have a Properties Booklet for the quizzes and exams. This Properties Booklet is purchased from the SDSMT Bookstore at a nominal cost, essentially that of duplicating the pages. You are not permitted to write anything on or in this booklet. Anything written (whether erased or not) will void the booklet for use during quizzes and exams. Refer to statement 4 above.

IF YOU HAVE INFORMATION THAT OTHER CLASSMATES DO NOT HAVE DURING AN EXAM, QUIZ OR WHEN COMPLETING HOMEWORK ASSIGNMENTS, THEN CHEATING HAS OCCURRED.

IF YOU HAVE COPIED OR 'WRITTEN TOGETHER' ASSIGNMENTS FROM/WITH ANOTHER CLASSMATE AND NOT DECLARED THIS TEAMWORK ON YOUR ASSIGNMENT, THEN CHEATING HAS OCCURRED.