ENAE 788a
Fundamentals of Explosions: Natural, Accidental, and Controlled

Course Description: This course introduces the physics and chemistry of explosions and investigates how they occur naturally, accidentally, and by engineering design. Explosions occur when energy is released locally into a physical system faster than it can be smoothly equilibrated. The result is that the local pressure increases rapidly and shock waves form and propagate throughout the system. This general description covers scenarios including astrophysical events such as supernovae or solar magnetic eruptions, accidental catastrophes such as vapor-cloud or coalmine explosions, and engines for high-speed and micro-propulsion. All of these events are based on similar principles of compressible flow, energy release into this flow, and the formation and propagation of shock waves. This course will cover the basics needed to understand these phenomena, and then it will take a forensics approach to understanding specific types of scenarios of interest to the class.

Instructor: Prof. Elaine S. Oran, Office: Kim 3232. Email: eoran@umd.edu,
Office Phone: 301-405-7373; Cell: 571-214-6437

Lectures: Mon and Wed, 2:00 pm – 3:15 pm, Location to be determined.

Office Hours: To be announced and by appointment in Kim 3232
Please come by to discuss and ask questions! Suggest you call or text first.

Prerequisites: Students are expected to have an undergraduate-level understanding of calculus, fluid dynamics (particularly compressible flows), some combustion science, heat transfer, and thermodynamics. Students without these requirements, however, but with a strong interest are encouraged to contact the instructor for permission to take the course. A preliminary review of important elements of these topics will be given as part of the course.

Textbook: No textbook is available for this course. A list of useful references is being prepared and will be distributed as the course proceeds. A variety of reading materials, including excerpts from books, papers, instructor-prepared notes and webpages will be made available to the students through the semester.

Homework: Homework will be assigned approximately every week. Much of it will involve research on a topic, and then presentation to the class. These assignments will vary in difficulty and credit and could include laboratory assignments related to in-class activities. Assignments will be determined based on class interests.

Exams: One Midterm paper and presentation, One Final paper and presentation. The midterm exam will be an open book research-paper assignment and presentation. The final exam will be a lengthier take home research-paper assignment that must be turned in on the last day

of classes, December 10. The final may, but does not have to be an expansion of the midterm topic. This could be modified once the students' background and class composition are determined.

Course Grade:		
	Homework (*class and outside participation*)	30%
	Midterm paper & presentation	30%
	Final paper & presentation	40%
	Total	100%

Grading Policy: A weighted average, following the percentages above will be used to determine the final grade. There is flexibility with homework or projects if prior arrangements are made. Late work *will not be accepted without prior arrangements*. Concerns on the grading should be brought to the instructor.
Letter grades will be assigned with +/- values, so please note the university policy update: http://www.testudo.umd.edu/plusminusimplementation.html

Required Technology: This will be determined during the first class, based on what is available to the students in the class in terms of calculators, computers, software, etc.

Expectations for Students: Students are expected to read assigned materials in advance of lectures, attend lectures, present summaries of their homework research, take notes, do assigned homework on time and ***actively*** participate in the course. They are ***strongly*** encouraged to ask questions in class, arrange to come by to see the instructor, and keep the instructor informed of their progress. Students are encouraged to interact with each other on their assignments. Collaborations are encouraged. If the student has any concerns about the course, the instructor should be alerted personally or by email as soon as possible. This includes issues such as missing a class or late submissions.

Upon completing this course, the student should know:

- the underlying physics of explosions
- how to apply this information to new situations
- how to analyze the behavior of an explosion, both *a posteriori* and *a priori*.
- how to relate explosions to other combustion or energy deposition phenomena
- the basics of shock physics and compressible flow dynamics
- how to compute the effects of confinement on compressible flows
- the physics of at several different types of explosions