



ENES250 Why do things fail? – Summer 2025

Course Syllabus

Instructor

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Topics Covered

To answer the question “Why do things fail?” we must look beyond the specific conditions that cause a single point or a single component to fail. In this course, we will of course study how individual components fail, but a much larger emphasis will be placed on the myriad of other reasons why things fail. The course material is organized and presented around the following topics:

Individual Component Failures

- Basic concepts of Engineering Mechanics: Analysis of forces and moments

- Stresses & failure modes

- Material properties

- Group work exercise on individual component failures

System Failures

- Reliability of complex systems (why are complex systems less reliable?)

- Design Failure Modes & Effects Analysis (DFMEA)

- Root cause analysis

- Case study & hands-on activity on system failures

Failures during the Design Process

- Ill-defined user needs: customer requirements and human factors

- Wrong product performance specifications

- Inadequate design verification testing

- Business failures (Time, cost, resources, competitive pressures, stakeholder/investor expectations)

- Engineering Ethics

- Case study & hands-on activity on failures during the design process

Failures in Manufacturing

- Manufacturing errors & defects

- Process Failure Modes & Effects Analysis (PFMEA)

- Lapses in or lack of quality control systems

- Case study & hands-on activity on failures in Manufacturing

Failures in service (during the life of the product)

- Unintended or unforeseen use

- Lapses in maintenance

- End of life (and infant mortality) failures – The bathtub curve

- Excessive and unexpected loading (including natural disasters)

- Case study & hands-on activity on failures in service

Course Schedule

The detailed daily schedule of topics and activities will be posted on the course portal prior to the first day of classes.

Class Format – 100% in Person

All instruction will be delivered in person daily. The class will meet **from 9am to 12:00pm**. The format of the class will vary from day to day, but the following activities are to be expected: Short lectures, brief video viewings, demonstrations, student group work activities, student presentations, quizzes or other assessments.

Course Canvas Portal

<http://www.elms.umd.edu/>

On the Canvas Course Portal, you will find the most updated information pertaining to the course. Most notably, you can find information about case studies, videos, homework assignments, and assessment information.

Course Objectives

During this course, students will develop an understanding and appreciation of the multiple reasons for which things fail. Students will be able to identify engineering problems by applying basic principles of engineering mechanics to predict limits of performance and predict failure points on individual components. Students will be able to communicate effectively with a range of audiences including peers and teaching staff. They will be able to recognize ethical and professional responsibilities of engineers. Students will become comfortable working with others, working on teams, writing reports, presenting findings, and communicating effectively.

Grading

Individual reflections	30%
Individual assignments	20%
Team work assignments	25%
Design project	30%

Letter Grade Assignments

95-100:	A+	75-79.99:	C+
90-94.99:	A	70-74.99:	C
85-89.99:	B+	60-69.99:	D
80-84.99:	B	0-59.99:	F

Individual Assessments

Periodically, students will be assigned reading or video reviewing assignments, with specific prompts for which they may be quizzed on. The quizzes may consist of simple problems, questions about reading assignments, or other conceptual material covered in prior classes. Other times, students will be asked to work on engineering problems leading to a desired solution. Periodically, students will be asked to write individual reflections with prompts provided by the instructor. All individual assessments will be graded and returned to students in a timely manner.

Team Work Assessments

At the conclusion of each course module, a case study or project will be used to highlight the key learning outcomes. Students will be asked to work in teams to research, write, and present their findings in the presence of their peers and instructors. Students will be evaluated as a team, and each team member will receive the same score as their team. In some cases, a peer evaluation may be requested for certain team assignments, which may be used to adjust an individual student's score on team projects. There will be a team design project towards the end of the course.

Class Participation

The course is designed to elicit participation from all students. Student to student as well as student to instructor interactions are required. Attendance and participation will be monitored and evaluated throughout the course.

Academic Integrity Policy

The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students (link below). As a student, you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. The student code of academic integrity can be accessed here: <https://policies.umd.edu/academic-affairs/university-of-maryland-code-of-academic-integrity>

University Course Related Policies

For further details on course related policies mentioned above, as specified by the University, go to <http://www.ugst.umd.edu/courserelatedpolicies.html>

Course Evaluations

Your participation in the evaluation of courses through CourseEvalUM is a responsibility you hold as a student member of our academic community. Your feedback is confidential and important to the improvement of teaching and learning at the University as well as to the tenure and promotion process. CourseEvalUM will be open for you to complete your evaluations near the end of the term. Please go directly to www.courseevalum.umd.edu to complete your evaluations when available. By completing all of your evaluations each semester, you will have the privilege of accessing online, at Testudo, the evaluation reports for the thousands of courses.

Respect and Inclusion

It is critical that the classroom is a forum where all students feel comfortable and excited to learn. Students and instructional team members must conduct themselves in a professional manner and work together to foster and preserve an inclusive classroom environment. Any behavior (including harassment and racially and/or culturally derogatory language) that threatens this atmosphere will not be tolerated. No class member or instructor should ever feel intimidated, threatened, or unwelcome.

Therefore, the class policy is that the language used and the actions taken in this class are respectful and inclusive of all members of the classroom community. Any deviation from this policy will not be tolerated and students may be asked to leave the class session if their actions or words break this policy. This policy extends to synchronous and asynchronous group work. Please express any concerns to a member of the instructional team immediately if you feel threatened, dismissed, or silenced at any point during the semester and/or if your engagement in discussion has been in some way hindered by the learning environment.