

ME 415

Flight Vehicle Design

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Syllabus

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What is this course about?

The subject of this course is aircraft and rocket design. You will learn some of the basics of aerodynamics, structures, stability, propulsion, and performance as applied to flight vehicle design. In other words, you will be exposed to the fundamentals of aerospace engineering. Rather than a deep

dive into any one discipline, our focus is understanding tradeoffs amongst multiple disciplines to enable vehicle-level design. The class involves a combination of theory, analytic methods, computational tools, and a hands-on design project.

What is this project about?

After we've practiced fundamentals through homework assignments, we'll spend about 3 weeks building gliders in small teams. We'll then spend a day at the park playing "glider golf". The project will give us a better feel for aerodynamic tradeoffs and the importance of static stability.

How does this course relate to other courses?

The content of this class is the typical launching point for a mechanical engineer wishing to specialize in aerospace engineering. Subsequent courses provide greater depth on topics that we can only cover at an introductory level in this class. See the **aerospace emphasis** (catalog will have latest class options) for other classes in this area.

What are the prerequisites?

Formally, the listed prerequisites are: ME EN 273, ME EN 312. The latter may be taken concurrently (but you may need to read ahead a bit or ask a classmate to explain if unfamiliar concepts come up). We do *not* assume any prior exposure to aircraft or spacecraft.

Some of you are from other departments, like physics. You'll be fine, though you should ask your classmates for help, as needed, in explaining some engineering concepts or terminology from fluids, dynamics, and structures that are re-used in this class.

What will the in-class experience be like?

Most classes will be oriented around self-discovery. I'd recommend that you read the textbook or watch videos *after* lectures. Research suggests that concepts will stick with you better if you wrestle with them before being introduced to the "right way". To that end, in class I will ask lots of questions, ask you to predict things, draw charts, debate concepts with your neighbor, or try to solve problems that you haven't seen before.

What textbook will we use?

I've developed a text specifically for this class linked on the schedule page. I've created this because there was no *one* textbook at the appropriate level or with the right mix of topics for this class. The textbook may be updated periodically.

Introduction to Flight by John Anderson (any edition) is a good supplementary text. It is not necessary for the class, but will provide more context for those interested. The level of that text is a bit too basic for our needs, but does provide a nice introduction to a broad range of topics.

I've also created videos on topics from a prior year also linked on the schedule page. I emphasize some topics differently, and have added some new material, but most of the content overlaps if you want to review.

What are the assignments?

There will generally be an assignment due every Wednesday at midnight (11:59pm) via Learning Suite. These will be submitted as a "quiz" on Learning Suite, except that unlike normal quizzes you can open and exit as much as you like before the deadline. Make sure what you submit is clear, well-labeled, etc.

We will also have weekly quizzes to help you and I gauge understanding and reinforce concepts. Quizzes will be low weight. You are allowed to take a quiz twice. The first time should be closed-book. This helps you with retrieval, a practice that promotes learning. The second time is open-book and your score will be the best of the two attempts, which should be the latter!

Besides the project, there are also two midterm exams and one comprehensive final exam.

What about late work?

Late homework will be accepted with a penalty of 20% per day. Last minute issues often happen in life so be sure to start your work early and submit early! Despite your best planning you will likely have an unexpected event,

obligation, or illness pop up. To help with this, I will give you three free late days (total per semester, not per assignment). This policy is designed to help with unexpected issues, so we generally won't grant other extensions (unless of course there are prolonged/significant disruptions).

We won't re-open late quizzes, but instead will drop two quizzes because we all forget or have occasional emergencies.

Can I work with others? AI?

Working with others on homework is definitely encouraged, but you must do your own analysis and your own write-ups. When working with classmates, TAs, or AI, it is not appropriate to seek out solutions but rather to reinforce understanding. When using AI, you should ask questions like you would interact with a TA. For example, ask for feedback on your approach, or prompt it to ask you guided questions to help you figure out a problem. AI will not be allowed on exams.

University and Department Policies

Honor Code

In keeping with the principles of the BYU Honor Code, students are expected to be honest in all of their academic work. Academic honesty means, most fundamentally, that any work you present as your own must in fact be your own work and not that of another. Violations of this principle

may result in a failing grade in the course and additional disciplinary action by the university. Students are also expected to adhere to the Dress and Grooming Standards. Adherence demonstrates respect for yourself and others and ensures an effective learning and working environment. It is the university's expectation, and every instructor's expectation in class, that each student will abide by all Honor Code standards. Please call the Honor Code Office at 422-2847 if you have questions about those standards.

Academic Honesty (Department)

As part of an overall teaching/learning approach to aid student learning, the course instructor may make available to students solutions to some prior coursework. However, outside of this appropriate usage, relying on and/or copying solutions (obtained online or from any source) to assigned coursework represents a clear example of turning in work that is not your own.

Inappropriate Use Of Course Materials

All course materials (e.g., outlines, handouts, syllabi, exams, quizzes, PowerPoint presentations, lectures, audio and video recordings, etc.) are proprietary. Students are prohibited from posting or selling any such course materials without the express written permission of the professor teaching this course. To do so is a violation of the Brigham Young University Honor Code.

Preventing & Responding to Sexual Misconduct

In accordance with Title IX of the Education Amendments of 1972, Brigham Young University prohibits unlawful sex discrimination against any participant in its education programs or activities. The university also prohibits sexual harassment-including sexual violence-committed by or against students, university employees, and visitors to campus. As outlined in university policy, sexual harassment, dating violence, domestic violence, sexual assault, and stalking are considered forms of "Sexual Misconduct" prohibited by the university.

University policy requires all university employees in a teaching, managerial, or supervisory role to report all incidents of Sexual Misconduct that come to their attention in any way, including but not limited to face-to-face conversations, a written class assignment or paper, class discussion, email, text, or social media post. Incidents of Sexual Misconduct should be reported to the Title IX Coordinator at t9coordinator@byu.edu or (801) 422-8692. Reports may also be submitted through EthicsPoint at <https://titleix.byu.edu/report> or 1-888-238-1062 (24-hours a day).

BYU offers confidential resources for those affected by Sexual Misconduct, including the university's Victim Advocate, as well as a number of non-confidential resources and services that may be helpful. Additional information about Title IX, the university's Sexual Misconduct Policy, reporting requirements, and resources can be found at <http://titleix.byu.edu> or by contacting the university's Title IX Coordinator.

Student Disability

Brigham Young University is committed to providing a working and learning atmosphere that reasonably accommodates qualified persons with disabilities. If you have any disability which may impair your ability to complete this course successfully, please contact the University Accessibility Center (UAC), 2170 WSC or 422-2767. Reasonable academic accommodations are reviewed for all students who have qualified, documented disabilities. The UAC can also assess students for learning, attention, and emotional concerns. Services are coordinated with the student and instructor by the UAC. If you need assistance or if you feel you have been unlawfully discriminated against on the basis of disability, you may seek resolution through established grievance policy and procedures by contacting the Equal Employment Office at 422-5895, D-285 ASB.

Respectful Environment

“Sadly, from time to time, we do hear reports of those who are at best insensitive and at worst insulting in their comments to and about others... We hear derogatory and sometimes even defamatory comments about those with different political, athletic, or ethnic views or experiences. Such behavior is completely out of place at BYU, and I enlist the aid of all to monitor carefully and, if necessary, correct any such that might occur here, however inadvertent or unintentional. “I worry particularly about demeaning comments made about the career or major choices of women or men either directly or about members of the BYU community generally. We

must remember that personal agency is a fundamental principle and that none of us has the right or option to criticize the lawful choices of another.” President Cecil O. Samuelson, Annual University Conference, August 24, 2010 “Occasionally, we … hear reports that our female faculty feel disrespected, especially by students, for choosing to work at BYU, even though each one has been approved by the BYU Board of Trustees. Brothers and sisters, these things ought not to be. Not here. Not at a university that shares a constitution with the School of the Prophets.” Vice President John S. Tanner, Annual University Conference, August 24, 2010

Devotional Attendance

Brigham Young University’s devotional and forum assemblies are an important part of your BYU experience. President Cecil O. Samuelson said, “We have special and enlightening series of devotional and forum assemblies…that will complement, supplement, and enrich what will also be a very productive period in your classrooms, laboratories, and libraries. We look forward to being with you each Tuesday…and hope that you will regularly attend and bring your friends and associates with you…A large part of what constitutes the unique ‘BYU experience’ is found in these gatherings where the Spirit has been invited and where we have the opportunity to discuss and consider things of ultimate worth and importance that are not afforded to the academic community on almost any other campus” (from the address “The Legacy of Learning”, 30 August, 2005). Your attendance at each forum and devotional is strongly encouraged.

Mental Health

Mental health concerns and stressful life events can affect students' academic performance and quality of life. BYU Counseling and Psychological Services (CAPS, 1500 WSC, 801-422-3035, caps.byu.edu) provides individual, couples, and group counseling, as well as stress management services. These services are confidential and are provided by the university at no cost for full-time students. For general information please visit <https://caps.byu.edu>; for more immediate concerns please visit <http://help.byu.edu>.

Academic Honesty

The first injunction of the Honor Code is the call to "be honest." Students come to the university not only to improve their minds, gain knowledge, and develop skills that will assist them in their life's work, but also to build character. "President David O. McKay taught that character is the highest aim of education" (The Aims of a BYU Education, p.6). It is the purpose of the BYU Academic Honesty Policy to assist in fulfilling that aim. BYU students should seek to be totally honest in their dealings with others. They should complete their own work and be evaluated based upon that work. They should avoid academic dishonesty and misconduct in all its forms, including but not limited to plagiarism, fabrication or falsification, cheating, and other academic misconduct.

Plagiarism

Intentional plagiarism is a form of intellectual theft that violates widely recognized principles of academic integrity as well as the Honor Code. Such plagiarism may subject the student to appropriate disciplinary action administered through the university Honor Code Office, in addition to academic sanctions that may be applied by an instructor. Inadvertent plagiarism, which may not be a violation of the Honor Code, is nevertheless a form of intellectual carelessness that is unacceptable in the academic community. Plagiarism of any kind is completely contrary to the established practices of higher education where all members of the university are expected to acknowledge the original intellectual work of others that is included in their own work. In some cases, plagiarism may also involve violations of copyright law. Intentional Plagiarism-Intentional plagiarism is the deliberate act of representing the words, ideas, or data of another as one's own without providing proper attribution to the author through quotation, reference, or footnote. Inadvertent Plagiarism-Inadvertent plagiarism involves the inappropriate, but non-deliberate, use of another's words, ideas, or data without proper attribution. Inadvertent plagiarism usually results from an ignorant failure to follow established rules for documenting sources or from simply not being sufficiently careful in research and writing. Although not a violation of the Honor Code, inadvertent plagiarism is a form of academic misconduct for which an instructor can impose appropriate academic sanctions. Students who are in doubt as to whether they are providing proper attribution have the responsibility to consult with their instructor and obtain guidance. Examples

of plagiarism include: Direct Plagiarism-The verbatim copying of an original source without acknowledging the source. Paraphrased Plagiarism-The paraphrasing, without acknowledgement, of ideas from another that the reader might mistake for the author's own. Plagiarism Mosaic-The borrowing of words, ideas, or data from an original source and blending this original material with one's own without acknowledging the source.

Insufficient Acknowledgement-The partial or incomplete attribution of words, ideas, or data from an original source. Plagiarism may occur with respect to unpublished as well as published material. Copying another student's work and submitting it as one's own individual work without proper attribution is a serious form of plagiarism.