

Syllabus AE 442 – Aircraft Systems Design I

Instructor: Jason Merret
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TAs: Rodra Hascaryo (hascary2@illinois.edu)
Office Hours: TBD
Location: 327 Talbot, Desk 19
Zoom Meeting URL (if required, see Note below):
Note: Please email ahead of time if you wish to attend via Zoom

Wanzheng Zheng (wz10@illinois.edu)
Office Hours: TBD
Location: TBD
Zoom Meeting URL

Sneha Gayen (sgayen2@illinois.edu)
Office Hours: TBD
Location: TBD
Zoom Meeting URL

Credit: 3 hours

Class Information

Meeting Schedule: Tuesdays and Thursdays 3:30 – 4:50 PM
Meeting Location: 2310 Everitt Lab

Instructor Office Hours:

Wednesday 10-11:30 AM

In-person Office Hours Location: 306G Talbot Lab

Meeting URL:

<https://illinois.zoom.us/j/82817728030?pwd=IYXtBTuyYbxKyPTAStqzvKkbn43gNm.1>

Meeting ID: 828 1772 8030

Password: 421029

Wednesday 2:30-4:00 PM

In-person Office Hours Location: 306G Talbot Lab

Meeting URL:

<https://illinois.zoom.us/j/88007001104?pwd=g5cEIIghMHgyD8NuGRHEL25R7RaYxU.1>

Meeting ID: 880 0700 1104

Password: 540803

Required Text:

A physical copy is highly recommended for the exams.

Raymer, D., *Aircraft Design: A Conceptual Approach*, 6th Edition, AIAA Inc., Reston, VA, 2012.

Recommended Design Texts:

Nicolai, L. and Carichner, G., *Fundamentals of Aircraft and Airship Design: Volume I-Aircraft Design*, AIAA, Inc., Reston, VA, 2010.

Torenbeek, E., *Synthesis of Subsonic Airplane Design*, Springer, New York, NY, 1982.

Roskam, J., *Airplane Design, Parts I-VIII*, 2nd Edition, DAR Corporation, Lawrence, KS, 2003.

Anderson, J., *Introduction to Flight*, 7th Edition, McGraw-Hill Education, New York, NY, 2011.

Duawalter, C., and Althof, E. (Eds.), *AIAA Design Engineers Guide*, AIAA Inc., Reston, VA, 2012.

Kuchemann, D., *The Aerodynamic Design of Aircraft*, AIAA Inc., Reston, VA, 2012.

Recommended Subject Specific Texts:

Aerodynamics and Flight Mechanics

Roskam, J. and Lan, C., *Airplane Aerodynamics and Performance*, DAR Corporation, Lawrence, KS, 1997.

Yechout, Thomas R, and Steven L. Morris. *Introduction to Aircraft Flight Mechanics: Performance, Static Stability, Dynamic Stability, and Classical Feedback Control*. Reston, VA: American Institute of Aeronautics and Astronautics, 2003

Kundu, Ajoy K, Mark Price, and David Riordan. *Theory and Practice of Aircraft Performance*. , 2016.

Roskam, J., *Airplane Flight Dynamics and Flight Controls Part I*, DAR Corporation, Lawrence, KS, 1995.

McCormick, B., *Aerodynamics, Aeronautics, and Flight Mechanics*, 2nd Edition, John Wiley and Sons, New York, NY, 1995.

Hoerner, S., *Fluid Dynamic Drag, Aerodynamic Drag and Hydrodynamic Resistance*, S. Hoerner, Great Britain, 1992.

Hoerner, S. and Borst H., *Fluid Dynamic Lift, Practical Information on Aerodynamic and Hydrodynamic Lift*, S. Hoerner, Great Britain, 1985.

Keuthe, A. and Chow, C., *Foundations of Aerodynamics*, 5th Edition, John Wiley and Sons, New York, NY, 1998

Katz, J. and Plotkin, A., *Low-Speed Aerodynamics*, 2nd Edition Cambridge University Press, New York, NY, 2001.

Etkin, B., *Dynamics of Atmospheric Flight*, Dover Publications, Inc., Mineola, NY, 2005.
(Original work published 1972)

Abbott, I. and Von Doenhoff, A., *Theory of Wing Sections*, Dover Publications, Inc., New York, NY, 1959. (Original work published 1949)

Anderson, J., *Modern Compressible Flow*, 2nd Edition, McGraw-Hill Publishing Co., New York, NY, 1990.

Anderson, J., *Fundamentals of Aerodynamics*, 5th Edition, McGraw-Hill Publishing Co., New York, NY, 2010.

Propulsion

Oates, G., *Aerothermodynamics of Gas Turbine and Rocket Propulsion*, 3rd Edition, AIAA Inc., Reston, VA, 1997.

Mattingly, J., *Elements of Propulsion; Gas Turbines and Rockets*, 2nd Edition, AIAA Inc., Reston, VA, 2016.

Kurzke, J., and Halliwell, I., *Propulsion and Power*, Springer International Publishing AG, Cham, Switzerland, 2018.

Hill, P., and Peterson, C., *Mechanics And Thermodynamics Of Propulsion*, 2nd Edition, Addison-Wesley Publishing, Reading Ma, 1992.

Structures

Bruhn, E., *Analysis and Design of Flight Vehicle Structures*, Jacobs Publishing Inc., Indianapolis, TX, 1973.

Donaldson B., *Analysis of Aircraft Structures An Introduction*, McGraw-Hill Publishing Co., New York, NY, 1993.

Megson, T. H. G., *Aircraft Structures for Engineering Students*, 6th Edition, Butterworth-Heinemann Is an Imprint of Elsevier, Amsterdam, 2016.

Aircraft Systems

Moir, I., and Seabridge, A., *Aircraft Systems: Mechanical, Electrical, and Avionics Subsystems Integration*, 3rd Edition, John Wiley and Sons, New York, NY, 2011.

Currey, N., *Aircraft Landing Gear Design: Principles and Practices*, AIAA Inc., Reston, VA, 1998.

Topical Outline: (Red denotes if time permits)

Topics	Classes
1. Intro and What is Aircraft Design (Notes)	2
2. Similarity Analysis (Notes)	1
3. Requirements (Notes)	1
4. System Engineering / ConOps (Notes)	1
5. Atmospheric and Airspeed (Raymer App. C & McCormick Ch. 2)	1
6. Performance (Raymer Chs. 5 & 17)	2
7. Aerodynamics (Raymer Chs 4,5, & 12)	3
8. Mass Properties (Raymer Ch. 15)	1
9. Propulsion (Raymer Ch. 10)	2
10. Constraints and Basic Sizing/MDO (Raymer Chs. 2, 3, 19, 24)	4
11. Multi-Fidelity Approach (Raymer Chs. 2, 3, 19, 24)	1
12. Structures (Raymer Ch. 14)	1
13. Configuration and Loft (Raymer Ch. 7)	1
14. Team Presentations	3
15. AIAA Competition and Team Makeup (Notes)	2
16. Exam	1
17. Stability and Control	2
18. Systems	1
19. Review, HW Review, and Slack Time	3
Total	33
Classes	

Midterm and Final:

The midterm will be tentatively during class on Tuesday Oct. 15th.

The Final will be 1:30pm-4:30pm., Monday Dec. 16th.

Grading:

Homework and quizzes	15%
Presentation	15%
Exams (Midterm and Final)	20%/30%
Project(s)	20 %

Notes:

Failure to turn in the project or participate in presentation may result in failure of the class.

The use of CHATGPT (or alike) will be considered plagiarism in this course. This will result in a FAIR report.

Grading will be a straight scale (with +/-) or a curve depending on the distribution of the grades.

Straight Scale

100 - 90	A
89.99 – 80	B
79.99 – 70	C
69.99 – 60	D
59.99 – 00	F

Homework:

All homework will be specified and completed in the format described on each assignment. Not adhering to the requirements will impact grading. All homework will be submitted through Canvas. Homework must be clearly written and typed when pertinent. The instructor reserve the right to adjust homework due date for students in special circumstances.

Only the last submission will be graded.

Course Description:

Principles of systems engineering as they apply to the design process for aerospace flight systems, general design methodology, and application of these concepts to the initial sizing of both aircraft and spacecraft systems. Intensive technical writing. 3 undergraduate hours. No graduate credit. AE 442 and AE 443 taken in sequence fulfill the Advanced Composition Requirement.

Prerequisite: Credit or concurrent registration in AE 311, AE 323, and AE 352.

Class Diversity Understanding

We at UIUC are committed to providing equal opportunity for all persons, regardless of race, ethnicity, religion, sex, gender identity or expression, creed, age, ancestry, national origin, handicap, sexual orientation, political affiliation, marital status, developmental disability, or arrest or conviction record. We value diversity in all of its definitions, including who we are, how we think, and what we do. We cultivate an accessible, inclusive, and equitable culture where everyone can pursue their passions and reach their potential in an intellectually stimulating and respectful environment. We will continue to create an inclusive campus culture where different perspectives are respected and individuals feel valued. Please join us in these purposeful efforts to continue to improve our university together. As this is a continuing process, we all have to be aware that mistakes may happen and extend to each other understanding and the ability to learn and grow our respect and regard for each other.

University and Grainger College of Engineering Statements

COVID

Following University policy, all students are required to engage in appropriate behavior to protect the health and safety of the community, including wearing a facial covering properly, maintaining social distance (at least 6 feet from others at all times), disinfecting the immediate seating area, and using hand sanitizer. Students are also required to follow the campus COVID-19 testing protocol.

Students who feel ill must not come to class. In addition, students who test positive for COVID-19 or have had an exposure that requires testing and/or quarantine must not attend class. The University will provide information to the instructor, in a manner that complies with privacy laws, about students in these latter categories. These students are judged to have excused absences for the class period and should contact the instructor via email about making up the work.

Students who fail to abide by these rules will first be asked to comply; if they refuse, they will be required to leave the classroom immediately. If a student is asked to leave the classroom, the non-compliant student will be judged to have an unexcused absence and reported to the Office for Student Conflict Resolution for disciplinary action. Accumulation of non-compliance complaints against a student may result in dismissal from the University.

All students, faculty, staff, and visitors are required to wear face coverings in classrooms and university spaces. This is in accordance with CDC guidance and University policy and expected in this class.

Please refer to the University of Illinois Urbana-Champaign's COVID-19 website for further information on face coverings. Thank you for respecting all of our well-being so we can learn and interact together productively.

In order to implement COVID-19-related guidelines and policies affecting university operations, instructional faculty members may ask students in the classroom to show their Building Access

Status in the Safer Illinois app or the Boarding Pass. Staff members may ask students in university offices to show their Building Access Status in the Safer Illinois app or the Boarding Pass. If the Building Access Status says “Granted,” that means the individual is compliant with the university’s COVID-19 policies—either with a university-approved COVID-19 vaccine or with the on-campus COVID-19 testing program for unvaccinated students.

Students are required to show only the Building Access Screen, which shows compliance without specifying whether it was through COVID-19 vaccination or regular on-campus testing. To protect personal health information, this screen does not say if a person is vaccinated or not. Students are not required to show anyone the screen that displays their vaccination status. No university official, including faculty members, may ask students why they are not vaccinated or any other questions seeking personal health information.

Emergency Response Recommendations

Emergency response recommendations can be found at the following website:
<http://police.illinois.edu/emergency-preparedness/>. I encourage you to review this website and the campus building floor plans website within the first 10 days of class.
<http://police.illinois.edu/emergency-preparedness/building-emergency-action-plans/>.

Sexual Misconduct Reporting Obligation

The University of Illinois is committed to combating sexual misconduct. Faculty and staff members are required to report any instances of sexual misconduct to the University’s Title IX Office. In turn, an individual with the Title IX Office will provide information about rights and options, including accommodations, support services, the campus disciplinary process, and law enforcement options.

A list of the designated University employees who, as counselors, confidential advisors, and medical professionals, do not have this reporting responsibility and can maintain confidentiality, can be found here: wecare.illinois.edu/resources/students/#confidential.

Other information about resources and reporting is available here: wecare.illinois.edu.

Academic Integrity

The University of Illinois at Urbana-Champaign Student Code should also be considered as a part of this syllabus. Students should pay particular attention to Article 1, Part 4: Academic Integrity. Read the Code at the following URL: <http://studentcode.illinois.edu/>.

Academic dishonesty may result in a failing grade. Every student is expected to review and abide by the Academic Integrity Policy: <https://studentcode.illinois.edu/article1/part4/1-401/>. Ignorance is not an excuse for any academic dishonesty. It is your responsibility to read this policy to avoid any misunderstanding. Do not hesitate to ask the instructor(s) if you are ever in doubt about what constitutes plagiarism, cheating, or any other breach of academic integrity.

Religious Observances

Illinois law requires the University to reasonably accommodate its students' religious beliefs, observances, and practices in regard to admissions, class attendance, and the scheduling of examinations and work requirements. You should examine this syllabus at the beginning of the semester for potential conflicts between course deadlines and any of your religious observances. If a conflict exists, you should notify your instructor of the conflict and follow the procedure at <https://odos.illinois.edu/community-of-care/resources/students/religious-observances/> to request appropriate accommodations. This should be done in the first two weeks of classes.

Disability-Related Accommodations

To obtain disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor and the Disability Resources and Educational Services (DRES) as soon as possible. To contact DRES, you may visit 1207 S. Oak St., Champaign, call 333-4603, e-mail disability@illinois.edu or go to <https://www.disability.illinois.edu>. If you are concerned you have a disability-related condition that is impacting your academic progress, there are academic screening appointments available that can help diagnosis a previously undiagnosed disability. You may access these by visiting the DRES website and selecting “Request an Academic Screening” at the bottom of the page.

Family Educational Rights and Privacy Act (FERPA)

Any student who has suppressed their directory information pursuant to Family Educational Rights and Privacy Act (FERPA) should self-identify to the instructor to ensure protection of the privacy of their attendance in this course. See <https://registrar.illinois.edu/academic-records/ferpa/> for more information on FERPA.

Anti-Racism and Inclusivity Statement

The Grainger College of Engineering is committed to the creation of an anti-racist, inclusive community that welcomes diversity along a number of dimensions, including, but not limited to, race, ethnicity and national origins, gender and gender identity, sexuality, disability status, class, age, or religious beliefs. The College recognizes that we are learning together in the midst of the Black Lives Matter movement, that Black, Hispanic, and Indigenous voices and contributions have largely either been excluded from, or not recognized in, science and engineering, and that both overt racism and micro-aggressions threaten the well-being of our students and our university community.

The effectiveness of this course is dependent upon each of us to create a safe and encouraging learning environment that allows for the open exchange of ideas while also ensuring equitable opportunities and respect for all of us. Everyone is expected to help establish and maintain an environment where students, staff, and faculty can contribute without fear of personal ridicule, or intolerant or offensive language. If you witness or experience racism, discrimination, micro-aggressions, or other offensive behavior, you are encouraged to bring this to the attention of the course director if you feel comfortable. You can also report these behaviors to the Bias Assessment and Response Team (BART) (<https://bart.illinois.edu/>). Based on your report, BART members will follow up and reach out to students to make sure they have the support they need to be healthy and safe. If the reported behavior also violates university policy, staff in the Office for Student Conflict Resolution may respond as well and will take appropriate action. be healthy and safe. If the reported behavior also violates university policy, staff in the Office for Student Conflict Resolution may respond as well and will take appropriate action.