Course Syllabus

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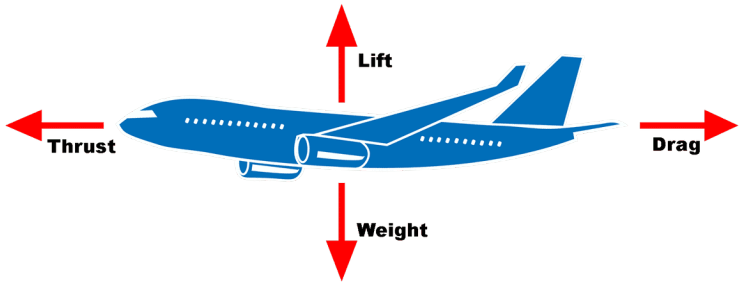
MAE 158

Aircraft Performance

Fall 2024



Instructor: Prof. J. Huynh TA: Mohammadreza Rostami

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Office Hours: Thursdays 12:00-1:00pm in EG 4212

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Office Hours: Tuesdays 9:00-10:00am in EG 2146

Reference text 1: *Fundamentals of Flight*, R. S. Shevell, 2nd Ed. Prentice Hall (available on UCI Science Library Course Reserves)

Reference text 2: *Aircraft Performance and Design*, J. D. Anderson, McGraw Hill

Lecture: In-person TuTh 2:00-3:20pm, RH 101 (https://classrooms.uci.edu/classroomtechnology/classrooms/rh/rh-101)

Discussions: In-person F 12:00-12:50pm, 1:00-1:50pm, 2:00-2:50pm HICF 100N (https://classrooms.uci.edu/classroomtechnology/classrooms/hicf/hicf-100n) . You only need to attend one discussion section and can attend any session. Discussions will review recommended homework.

Course Outcomes: Students will demonstrate an understanding and ability to solve problems related to the basic principles of aircraft performance, including fluid mechanics, lift and drag, takeoff, climb, cruise, descent, and landing performance, stability and control fundamentals, and aircraft propulsion fundamentals.

Outline

Basic fluid mechanics

- continuity & momentum
- compressibility, Mach number
- viscosity
    - Reynolds number
    - boundary layer (laminar, transition, turbulent, separation)

Lift and drag

- theory of lift
    - 2D - circulation
    - 3D - downwash, induced drag
- viscous drag
    - laminar & turbulent skin friction
    - separation
- airfoil characteristics
    - 2D aerodynamic coefficients: c_l , c_d , c_m , c_{lmax}
    - camber & thickness
    - lift curve, drag polar, aerodynamic center
    - pressure coefficient & pressure distribution
    - classes of airfoils
    - high-lift systems

- stall speed

- compressibility drag

- supercritical flow

- simple sweep theory

- drag rise & critical Mach number

- wing characteristics

- 3D aerodynamic coefficients: C_L , C_D , C_M , C_{Lmax}

- aerodynamic center: C_{Mac}

- effect of aspect ratio, taper ratio, twist, sweep

- total airplane drag

- parasite

- induced, Oswald efficiency factor

- compressibility

Airplane performance

- steady level flight (L = W, T = D)

- C_L => weight, size, altitude, speed

- thrust or power available versus thrust or power required

- airspeed constraints: maximum, minimum, optimum

- climb: rate, angle, efficiency

- range: propeller, turbojet

- endurance: propeller, turbojet

- takeoff

- landing

Stability and control

- static & dynamic stability

- requirements for longitudinal static stability

- center-of-gravity, trim, neutral point

- comparison of conventional, canard and flying-wing configurations

Propulsion

- reciprocating engines & gas turbines
- propellers & momentum theory

Grading Policy

In-class Participation	5%
Discussion/quiz	15%
Midterm exam	30%
Final exam	40%
Project	10%

In-class participation will be graded based on polls for occasional in class concept questions. Questions will be graded for participation only (not for accuracy) and starting week 3, students will need to participate in 70% of questions throughout the quarter for full credit. Students will need access to an electronic device to answer questions on PollEverywhere (PollEv.com/maeaircraft). Register for PollEverywhere and bring an internet accessible laptop/smart phone to every class (see instructions at the bottom of the syllabus).

Recommended (ungraded) homework problems will be assigned weekly. After the discussion sessions, there will be a 1 hour-long Canvas quiz available for a fixed time window based on the lecture and recommended homework problems from that week. The quiz will include both multiple choice and fill-in-the-box numerical answer based questions. Students will be required to upload their written work along with inputting the final answer in a submit box. Each week, only the multiple choice and one randomly selected fill-in-the-box questions will be graded for accuracy while the others will be graded for completion if written work containing a reasonable attempt at solving the problem was submitted. Correct answers in the submit box will be marked as a full score. If the submit box answer is not correct, the uploaded written work will be checked for partial credit. The lowest quiz score will be dropped.

Exams will be in person with the midterm during the Thursday lecture of week 5 and the final during finals week. Students will be expected to bring a calculator and handwrite their exam work on the exam

sheets. Students are allowed a one-sided 8.5"x11” page of notes to use during the midterm exam and a two-sided 8.5"x11” page of notes for the final exam.

A drag calculator project will be assigned after the Midterm exam. It will involve a Matlab coding task and Solidworks task based on the aircraft performance topics learned in class. Please download and install Matlab and Solidworks for use on the project.

Course Policies

- **Communication Expectations:** Your professor or TAs will respond to emails within 24 hours during *business days.*
- **Class Withdrawal Policy**: It is the student's responsibility to officially drop/withdraw from any courses before the deadline posted by the university's registrar’s office. Please refer to UCI’s academic calendar **http://www.reg.uci.edu/enrollment/withdrawals/ (http://www.reg.uci.edu/enrollment/withdrawals/)** for the withdrawal policy, procedure, and refunded schedule.
- **Academic Integrity:** UCI is an institution of learning, research, and scholarship that is strengthened by the existence of an environment of integrity. As members of the academic community, students are responsible for maintaining this environment, and subscribe to the practice of academic integrity and accept individual responsibility for their work and actions. Violations of academic integrity are unacceptable and will not be tolerated, because they devalue the teaching and learning experience for the entire community. Observing basic honesty in one’s work, words, ideas, and actions is a principle to which all members of the community are required to subscribe. For more information, please visit **https://aisc.uci.edu/students/academicintegrity/index.php (https://aisc.uci.edu/students/academicintegrity/index.php%20%E2%97%8F)**
- **Diversity Statement**: The University of California, Irvine, in accordance with applicable Federal and State law and University policy, does not discriminate on the basis of race, color, national origin, religion, sex, gender identity, pregnancy, physical or mental disability, medical condition (cancer-related or genetic characteristics), ancestry, marital status, age, sexual orientation, citizenship, or service in the uniformed services. The University also prohibits sexual harassment. This nondiscrimination policy covers admission, access, and treatment in University programs and activities.
- **Disability Statement**: The University of California, Irvine, is committed to providing a barrier-free environment for learning and an electronic environment that is accessible to everyone, including individuals with disabilities. If you have a disability and feel you need accommodations in this program or a course, please contact the **Disability Services Center (https://dsc.uci.edu/)** (DSC). DSC approved accommodations will be provided for students who present a Faculty Notification Letter from the DSC.

- **Copyrights**: This course is provided by The University of California, which has **policies regarding copyright (https://www.oit.uci.edu/policy/copyright/)** . Materials used in connection with this course may be subject to copyright protection. Refer to the information provided in each video/file/module/unit for copyright information for each work. The course content related video/file/module/unit was created to be used in compliance with the TEACH Act. 17 U.S.C. §110(2). Selling, preparing, or distributing for any commercial purpose course lecture notes or video or audio recordings of any course unless authorized by the University in advance and explicitly permitted by the course instructor in writing. The unauthorized sale or commercial distribution of course notes or recordings by a student is a violation of these Policies whether or not it was the student or someone else who prepared the notes or recordings.

Student Support Resources

- **Remote Student Success Guide https://canvas.eee.uci.edu/courses/26868 (https://canvas.eee.uci.edu/courses/26868)**
- **UCI Learn Anywhere:** Remote learning resources for UCI students provided by DTEI and OIT is available at **https://sites.uci.edu/learnanywhere/ (https://sites.uci.edu/learnanywhere/)** .
- **Technical Support:** Contact the OIT helpdesk at **oit@uci.edu (mailto:oit@uci.edu)** or call (949) 824-2222 for all technical support and training needs.
- **UCI Wellness, Health, and Counseling:** For more information, please visit **https://studentaffairs.uci.edu/ (https://studentaffairs.uci.edu/)**
- **The Learning & Academic Resource Center (LARC) Online Tutoring** is available. Please visit **LARC's web site (https://larc.uci.edu/)** for details. Closed buildings on campus
- **Wellness Consulting Services:** Visit the UCI Counseling Center website at **http://www.counseling.uci.edu/ (http://www.counseling.uci.edu/)**

Course Requirements

- **Computer and Internet Connection:** You will need to have access to a device with an Internet connection in order to access the course content.
- **Access to the EEE+ Canvas Course space:** Students are expected to login to Canvas space every day to check for important class announcements. It is a student's responsibility to get familiar with the Canvas features as the course materials and assignments will be delivered via the EEE+ Canvas system. You can also contact the OIT Help Desk at **oit@uci.edu (mailto:oit@uci.edu)** or call (949) 824-2222 for assistance.
- **Update the Canvas Setting and Notification**: UCI students are given a UCI gmail account, but it may not be accessible in certain counties. Thus, it is very important you update the Canvas settings and notifications to ensure you receive the important messages and announcements from your

professor. Click on “setting” to add another email address and/or a cell phone number to receive notifications. Click on “notification” to configure how you receive Canvas notifications.

- **Virtual Learning Environments**: Canvas will be used for the weekly announcements, quizzes, and exams. The instructor and TAs will be sensitive to students' demand and feedback. Depending on this, this course may implement additional surveys and technology features. If you have any concerns about the remote course requirements, contact the OIT Help Desk at **oit@uci.edu (mailto:oit@uci.edu)** or call (949) 824-2222 for assistance, or contact **huynhlj@uci.edu (mailto:thomasj1@uci.edu)** immediately

Poll Everywhere

This class will be using Poll Everywhere. There are two things you need to do to make sure you will be able to participate successfully.

First, make sure your default email address in Canvas matches your email address as it is listed in the campus directory (**https://directory.uci.edu/ (https://directory.uci.edu/)**). This is required in order for Poll Everywhere to correctly report any grades or participation scores in the Canvas gradebook. Instructions for finding and updating your default email in Canvas are available here: **https://community.canvaslms.com/t5/Student-Guide/How-do-I-change-my-default-email-address-in-my-user-account-as-a/ta-p/410 (https://community.canvaslms.com/t5/Student-Guide/How-do-I-change-my-default-email-address-in-my-user-account-as-a/ta-p/410)**

Secondly, take a moment to sign in to Poll Everywhere with your UCInetID:

1. Open **pollev.com (https://sites.uci.edu/polling/poll-everywhere/pollev.com)**
2. Select Login on the left side of the page
3. Enter your @uci.edu email address as it is listed in the campus directory (https://directory.uci.edu/) and select Next
4. Login with your UCInetID and password
5. Complete your account setup by adding your name

For more information about completing Poll Everywhere activities, see **https://support.polleverywhere.com/hc/en-us/articles/1260801556349-Responding-to-questions (https://support.polleverywhere.com/hc/en-us/articles/1260801556349-Responding-to-questions)**

If you run into any technical difficulty or have any questions about your UCI Poll Everywhere account, please contact our campus support staff by emailing clickers@uci.edu or call the Classroom Technologies help line at (949) 824-8833.

Note that if you are accepting responses via SMS *and* if you are requiring registration and/or assigning any credit based on responses (whether for correctness, participation, or a combination thereof) then students who will be using SMS must take a moment to certify their phone numbers so that their SMS responses can be correctly associated with their accounts.

If this applies to your class, we recommend including in your syllabus a link to the phone certification instructions here: **Poll Everywhere – Certify your phone number (https://support.polleverywhere.com/hc/en-us/articles/1260801551589-Certify-your-phone-number)**

Course Summary:

Date	Details	Due
Mon Oct 14, 2024	**Week 2 Quiz (https://canvas.eee.uci.edu/courses/67897/assignments/1462563)**	due by 11:59pm
	Class Participation - Participation (https://canvas.eee.uci.edu/courses/67897/assignments/1465586)	
	Recommended Homework 1 (https://canvas.eee.uci.edu/courses/67897/assignments/1462571)	
	Recommended Homework 2 (https://canvas.eee.uci.edu/courses/67897/assignments/1462573)	
	Recommended Homework 3 (https://canvas.eee.uci.edu/courses/67897/assignments/1462574)	
	Recommended Homework 4 (https://canvas.eee.uci.edu/courses/67897/assignments/1462575)	