

MAE 3406-001 Flight Performance & Static Stability
Fall 2018

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Office Hours: MW 2:00 – 3:00 PM

Section Information: MAE 3406-001

Time and Place of Class Meetings: NH, Rm.110, MW 8:00-8:50 AM and F 8:00-9:50 AM

Description of Course Structure:

As one of your first courses in the professional portion of your degree plan, the format of MAE 3406 Flight Performance & Static Stability course will be somewhat different than what you have experienced in your first few years of basic university courses. The course is structured to provide the student the necessary fundamentals with an “industrial perspective” of the material and its use in that environment. As such, the professor will be your “customer/client/manager” and you, the student, are the “engineer” providing the requested analysis and presentation of the results. The intent is to prepare the student to quickly perform at a high level in industry upon graduation.

Course Content:

The course content will include a review of aircraft static stability & control (with some basic aerodynamics), propeller theory & basic engine performance and an introduction to aircraft performance. Topics covered include static stability & control, basic airfoil and wing theory, viscous flows and aircraft drag, propeller analysis & propulsion basics and air vehicle performance (cruise, climbing, gliding, maneuvering, range, endurance, etc.). Theory formulation, variable definition, analysis procedure and results presentation will follow industry standards. This shall include standard industrial practices developed by national and international agencies including ISO, Six Sigma, government (e.g., FARs, MIL STD) and professional organizations (e.g. AIAA, SAE).

Student Learning Outcomes:

With the successful completion of this course, the student shall have a basic understanding of the analysis techniques commonly used to predict aircraft performance, fundamental air vehicle static stability and control and the application of these processes as used in industry.

Textbooks and Other Course Materials:

Textbooks

Below is the text recommended by the department, but is not required. One can obtain older editions for use as a reference, if desired.

“Mechanics of Flight – 2nd Edition” by Warren F. Phillips, John Wiley & Sons, Inc. 2010, ISBN 978-0-470-53975-0 ()

The class will be using the professor’s notes and the text below. The primary text is provided to the class in a PDF format at no cost to the student. Used copies can be found on online auctions for \$9-\$15.

Perkins, C. D., and Hage, R. E., “Airplane Performance, Stability and Control,” John Wiley & Sons, Inc., 1949

References:

1. Dommasch, D. O., Sherby, S. S., and Connolly, T. F., "Airplane Aerodynamics," Pitman Publishing Corp., New York, 1961
2. Roskam, J. and Lan, C.T.E., "Airplane Aerodynamics and Performance," DARcorporation, First Edition, 1997
3. "Fundamentals of Fluid Mechanics" - 7th Edition by Munson, B.R., Okushi, T.H., Huebsch, W.H., and Rothmayer, A.P., John Wiley & Sons, Inc., 2013, ISBN 978-1-118-11613-5 (this is your fluid mechanics textbook)
4. Abbott, I. H., and von Doenhoff, A. E., "Theory of Wing Sections: Including a Summary of Airfoil Data," Dover Publishing Co., 1959
5. McCormick, Barnes W., "Aerodynamics, Aeronautics, and Flight Mechanics, 2nd ed.," John Wiley & Sons, Inc., New York, 1995.
6. Von Mises, R., "Theory of Flight," Dover Publishing Co., 1959
7. Drela, M., "Flight Vehicle Aerodynamics", MIT Press, 2014.
8. Gudmundsson, S., "General Aviation Aircraft Design: Applied Methods and Procedures", Butterworth-Heinemann, Waltham, MA, 2014
9. Hoerner, S. F., "Fluid Dynamic Drag: Practical Information on Aerodynamic Drag and Hydrodynamic Resistance," Hoerner Fluid Dynamics; 2nd edition (June 1965)
10. Hoerner, S. F., "Fluid Dynamic Lift," Hoerner Fluid Dynamics; 2nd edition (June 1992)

Reference 1 is an excellent text and can be found on eBay, etc. for less than \$10. Reference 4 is also an excellent data source and is available via most book sellers and online auctions (~\$19 new/\$10 used).

Descriptions of major assignments and examinations:

Exams:

- 2 - 50-min exams
 - a) Classical Aerodynamics – Airfoil, Wing, BoR and Aircraft Drag
 - b) Static Stability & Control
- 1 - Final exam –
 - a) Propeller Theory, Propulsion, Aircraft Performance and Mission Analysis

Homework:

- Homework/projects will be assigned throughout the semester.
- Due dates will be provided at the time of the assignment.
- All homework will follow engineering problem solution formats. (See Blackboard for example.)
- Assignments must be submitted online, into Blackboard (via PDF), no later than the beginning of class on the date due.
- It is recommended you keep a notebook of all your homework assignments.
- There will be **NO** make-up assignments. Missed or late assignments will receive a grade of zero.

Computer Projects:

- Specific topics requiring numerical analysis will be made throughout the semester. The write-up of the assigned project will follow the homework format. The results should include: the final results (form and content specified in the problem statement), the analysis flowchart and program source code (print out). The computer projects should be kept in the same notebook as the homework. Individual students will be scheduled, at random times, to come to the instructor's office and demonstrate their computer code's capability and results.
- Programs should be able to be run on a PC with software available to all students and faculty. Thus, acceptable programming languages/systems include: MatLab/Simulink, Mathematica and EXCEL (Office) or, if compiled using an alternate language (C, C++, Visual Basic, etc.) the executable must be able to be run and demonstrated on a PC based machine with Windows 7 or 10.

NOTE: For both Homework & Projects, plots will follow standard engineering formats. Chart Titles, Axis Titles, Legends, Scales and increment values, Grids & Tick marks, Descriptive textbox with pertinent information, etc. Failure to follow all the guidelines will result in a “zero” for item. An example of an engineering plot with annotations is provided in Blackboard.

Attendance/Participation:

Attendance will follow university rules. Attendance will be taken at the beginning of each class period utilizing a seating chart after the census date. If you are not seated when the attendance is taken, you will be marked as absent. Attendance and participation are part of the final grade.

Grading:

- Final Grade Weighting:

Homework/Computer Projects:	45%
2 – 50 minute exams:	15% each
Final Examination	15%
Attendance/Participation	10%
- Grade Allocation: Letter grades will be assigned by the following ranges
A (90-100), B (80-89), C (70-79), D (60-69), F (less than 60)

In order to receive a passing grade (“C” for Engineering majors), the weighted average of the 2-50 minute exams, homework, attendance/participation and the final examination must be 70 or above.

Grades will be posted on Blackboard for the students to review. Students are expected to keep track of their performance throughout the semester and seek guidance from all available sources (including the instructor) if their performance drops below satisfactory levels.

Homework & Project Policy:

- See “Homework and Projects” above in assignments.
- Due dates and times will be rigorously enforced. **Late assignments will not be accepted.**

Exam Policy:

- A final examination covering the last 3rd of the class material will be given at the conclusion of the course.
- There will be 2 – 50 minute exams distributed throughout the semester.
- No tablets, laptops or devices with internet access or massive storage capacity will be allowed in exams (see below). For all exams, the student will be allowed to bring a “formula/equation/concept” sheet. The content of the sheet is limited to one side of an 8.5”x11” sheet of paper. The sheet must be turned in with the exam. Failure to turn in the sheet will result in a grade penalty for that exam.
- There will be NO make-up exams or final exam. Missed exam will receive a grade of zero.
- The instructor must receive official notification (i.e. from the Testing Center) of any **‘Special Needs’** exam testing **within the first week of class**. The student must be registered and approved for special testing allowances. As such, the student is responsible for obtaining and presenting the necessary approved forms to the instructor in that first week. Additionally, **the student is responsible for coordinating all “special needs testing” with the test center two weeks before the final exam**. Per the university procedures, the testing center will contact the instructor and arrange the necessary private test schedule after the student has coordinated with the test center. **Failure to meet these requirements will negate any “special needs testing”.**

Course Schedule:

Topics covered:

Airplane Performance

- The Standard Atmosphere
- Classical Aerodynamics
 - a) Airfoil & Wing Basics

- b) Thin Airfoil Theory
 - c) 3-D Wing Theory
 - d) High Lift Systems
- Airplane Static Stability
 - a) Longitudinal Static Stability
 - b) Longitudinal Controls
 - c) Lateral-Directional Static Stability
 - d) Lateral-Directional Controls
- Viscous Fluid Flows, Boundary Layers and Aircraft Drag
- Propeller Theory
- Airplane Propulsion Systems
 - a) Basic Analysis & Performance of Various Propulsion Systems
- Fundamentals of Flight Performance
 - o Steady, Level Flight
 - a) Climb and Glide Performance
 - b) Range, Endurance And Payload-Range
 - c) C_{Do} , C_{Di} relationships
 - d) Take-off and Landing
 - e) Maneuvering and Flight Envelope
 - f) Accelerated Climb & Energy Maneuvering
- Every day “Rules of Thumb”
- Basic Aerodynamic Principles will be mixed throughout the course

Use of Electronic Devices

Cell phone use in class is prohibited at all times. Tablets and/or laptops may be used in class for taking notes. Only calculators may used in class for exams. No tablets, laptops or devices with internet access or massive storage capacity will be allowed in exams. (See note on exam “formula/equation/concept” sheets above.)

Expectations for Out-of-Class Study:

Beyond the time required to attend each class meeting, students enrolled MAE 3406, a 4-credit hour course, should expect to spend at least an additional 8-12 hours per week of their own time in course-related activities, including reading required materials, completing assignments, preparing for exams, etc. (The general rule of thumb is for every credit hour earned, a student should expect to spend ~2-3 hours per week working outside of class.)

Grade Grievances:

Any appeal of a grade in this course must follow the procedures and deadlines for grade-related grievances as published in the current undergraduate catalog.

Drop Policy:

Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance.** Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (<http://www.uta.edu/ses/fao>).

Americans with Disabilities Act:

The University of Texas at Arlington is on record as being committed to both the spirit and letter of all federal

equal opportunity legislation, including the Americans with Disabilities Act (ADA). All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of that disability. Any student requiring an accommodation for this course must provide the instructor with official documentation in the form of a letter certified by the staff in the Office for Students with Disabilities, University Hall 102. Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability or by calling the Office for Students with Disabilities at (817) 272-3364.

Title IX:

The University of Texas at Arlington is committed to upholding U.S. Federal Law "Title IX" such that no member of the UT Arlington community shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity. For more information, visit www.uta.edu/titleIX.

Academic Integrity:

Students enrolled all UT Arlington courses are expected to adhere to the UT Arlington Honor Code:

I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.

I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.

UT Arlington faculty members may employ the Honor Code as they see fit in their courses, including (but not limited to) having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System Regents' Rule 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University.

Lab Safety Training:

No lab training is required for this course.

Electronic Communication:

UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at <http://www.uta.edu/oit/cs/email/mavmail.php>.

Student Feedback Survey:

At the end of each term, students enrolled in classes categorized as "lecture," "seminar," or "laboratory" shall be directed to complete an online Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student's feedback enters the SFS database anonymously and is aggregated with that of other students enrolled in the course. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback is required by state law; students are strongly urged to participate. For more information, visit <http://www.uta.edu/sfs>.

Final Review Week:

A period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week unless specified in the class syllabus. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition,

instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

Student Support Services:

UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the Maverick Resource Hotline at 817-272-6107, send a message to resources@uta.edu, or view the information at www.uta.edu/resources.

The instructors reserve the right to make changes to the course syllabus as necessary. It is the student's responsibility to keep up with changes to the syllabus as posted on the class website.

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MAE 3406 – Flight Performance and Static Stability

Fall Semester 2018

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Flight Performance & Static Stability

MAE 3406

4 HOURS CREDIT

SPRING 2018

SYLLABUS

By signing this syllabus, the student acknowledges that he/she has read and understood this document.

Print Name: _____

Signature: _____ Date: _____

Prepared by: Dudley E. Smith

Date: 11 August 2018