

MAE 4351-001 Aerospace Vehicle Design II
Spring 2018

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Office Hours: 12-1:00 PM MW

Section Information: MAE 4351-003, MAE 4351-004 (lab)

Time & Place of Class Meetings: WH, Rm.210, MW 9:00-9:50 AM, Lab WH, AVDL, M 1:00-3:50 PM

Description of Course Structure:

As the principal design integration courses in the professional portion of your degree plan, the format of MAE 4350 Aerospace Vehicle Design I and MAE 4351 Aerospace Vehicle Design II are somewhat different than what you have experienced in your first few years of basic university courses. The courses are structured to provide the student with the integration of all their previous courses in an applied, design format. The lectures are presented with an “industrial perspective” of the material and its use in that environment is emphasized. 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.

In MAE 4351 the student is required to continue to exercise the knowledge obtained in the prerequisite courses (including MAE 4350) in the determination of a well-balanced multi-disciplinary flight vehicle system and develop an understanding of the design methodology through a highly structured lecture program and laboratory program aimed at developing an overall understanding for the design of aerospace systems.

Lecture Program: Emphasis has been placed on a generic presentation of the material being applicable to subsonic through hypersonic designs. The class text selected assembles a basic flight vehicle design compendium ultimately guiding the engineering apprentice towards the state-of-the-art of product synthesis.

Laboratory Program: Throughout the semester the students successively quantify a flight vehicle design case study by applying their theoretical, physical, and technical understanding. Emphasis has been placed on emulating an industry-typical disciplinary and multi-disciplinary design decision processes. Problem solving techniques range from by-hand calculations, the development of custom spreadsheet applications to specialist software execution. This laboratory program will enable the student engineer to build design proficiency for the range of design disciplines concerned. The laboratory (training) program exposes the student body to the overall design process, methods library, and a variety of software applications which can then be utilized for the final capstone design project this Spring.

Computer Use: The computer is used extensively for design computations (disciplinary analysis, vehicle synthesis), for utilizing and building technical databases, for configuration development and geometry visualization using a CAD system, for visuals for class presentations, and for producing weekly reports and the final report. Students are urged to utilize computer facilities provided by MAE to develop their own programs based on course text and lectures

Course Content:

The course content will include:

MAE 4350 –

1) Introduction, **2)** Review of Practical Aerodynamics, **3)** Aircraft Performance Methods, **4)** Aircraft Operating Envelope, **5)** Preliminary Estimate of Takeoff Weight, **6)** Estimating the Takeoff Wing Loading, **7)** Selecting the Planform and Airfoil Section, **8)** Preliminary Fuselage Sizing and Design, **9)** High-Lift Devices, **10)** Takeoff and Landing Analysis, **11)** Preliminary Sizing of the Vertical and Horizontal Tails, **12)** Designing for Survivability (Stealth), **13)** Estimating Wing-Body Aerodynamics, **14)** Propulsion System Fundamentals, **15)** Turbine Engine Inlet Design, **16)** Corrections for Turbine Engine Installation, **17)** Propeller Propulsion Systems, **18)** Propulsion System Thrust Sizing, **19)** Structures and Materials, **20)** Refined Weight Estimate, **21)** Static Stability and Control, **22)** Trim Drag and Maneuvering Flight, **23)** Control Surface Sizing Criteria, **24)** Life Cycle Cost, **25)** Trade Studies and Sizing.

MAE 4351 –

In addition to the above, the student will continue the process of step-wise refinement of analysis, modeling, design (layout), cost and technology of a concept air vehicle system. The development of a design synthesis code to optimize the solution will be one of the major efforts this semester. The code will allow the student teams to perform trades studies to evaluate technologies, social impact, etc. The results will allow the teams to finalize the development of their air vehicle.

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:

The MAE 4350/4351 two-semester aerospace design course sequence is developed to integrate the fundamental courses taken earlier throughout the curriculum by the aerospace or mechanical engineering student. In MAE 4351 the student is required to continue the step-wise refinement & development of a well-balanced multi-disciplinary flight vehicle system, understand the effects of technology, develop an understanding of the design methodology through a highly structured lecture program and laboratory program and develop an overall understanding for the design process of aerospace systems.

Prerequisites:

MAE 4350.

Required Textbooks and Other Course Materials:Textbook

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

Nicolai, L.M. and Carichner, G.E., “Fundamentals of Aircraft and Airship Design: Volume I – Aircraft Design”, AIAA Education Series, 2010

The class will be using the professor’s notes and the text below. (See professor for access.)

Gudmundsson, S., “General Aviation Aircraft Design: Applied Methods and Procedures”, Butterworth-Heinemann, Waltham, MA, 2014

References:

- Torenbeek, E., “*Synthesis of Subsonic Airplane Design*”, Delft University Press, 1982
- Roskam, J., “*Airplane Design – Parts I-VIII*”, First Edition, Second Printing, 1997

- Schaufele, R.D., *"The Elements of Aircraft Preliminary Design,"* First Edition, Aries Publications, 2000
- Dommasch, D. O., Sherby, S. S., and Connolly, T. F., *"Airplane Aerodynamics,"* Pitman Publishing Corp., New York, 1961
- Roskam, J. and Lan, C.T.E., *"Airplane Aerodynamics and Performance,"* DARcorporation, First Edition, 1997
- "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)
- Abbott, I. H., and von Doenhoff, A. E., *"Theory of Wing Sections: Including a Summary of Airfoil Data,"* Dover Publishing Co., 1959
- McCormick, Barnes W., *"Aerodynamics, Aeronautics, and Flight Mechanics, 2nd ed.,"* John Wiley & Sons, Inc., New York, 1995.
- Von Mises, R., *"Theory of Flight,"* Dover Publishing Co., 1959
- Drela, M., *"Flight Vehicle Aerodynamics,"* MIT Press, 2014.
- Hoerner, S. F., *"Fluid Dynamic Drag: Practical Information on Aerodynamic Drag and Hydrodynamic Resistance,"* Hoerner Fluid Dynamics; 2nd edition (June 1965)
- Hoerner, S. F., *"Fluid Dynamic Lift,"* Hoerner Fluid Dynamics; 2nd edition (June 1992)

Descriptions of major assignments and examinations:

Exams:

- 1 – Mid-term
 - Synthesis code, trade study results presentation and code demonstration
- 1 – Final
 - Formal final air vehicle report
 - Presentation, 30 minute formal presentation of the final design by each team

Homework:

- Various intermediate assignments will be made and evaluated to assess student/team progress.
 - (Example would be drag modeling of concept aircraft and incorporation within synthesis code.)

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.

Final Grade Weighting:

- Intermediate assignments 18%
- Mid-Term Presentation 18%
- Mid-Term Intermediate Report 18%
- Final Presentation 18%
- Final Report 18%
- 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), the weighted average (see above) of the exams, homework, 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 available sources (including the instructor) if their performance drops below satisfactory levels.

Homework & Project Policy:

- Intermediate assignments/projects will be assigned throughout the semester.
- Due dates will be provided at the time of the assignment.
- Assigned homework is officially due at the beginning of class on the due date.
- All homework will follow engineering problem solution formats. (See Blackboard for example.)
- You should keep a homework notebook with all your work within and bring it to every class.
- Assignment will randomly be requested and graded. These will constitute your homework grade. You only need to remove from your notebook and turn in upon request.
- There will be **NO** make-up assignments. Missed or late assignments will receive a grade of zero.

Exam Policy:

- NA

Attendance: At The University of Texas at Arlington, taking attendance is not required but attendance is a critical indicator in student success. Each faculty member is free to develop his or her own methods of evaluating students' academic performance, which includes establishing course-specific policies on attendance. However, while UT Arlington does not require instructors to take attendance in their courses, the U.S. Department of Education requires that the University have a mechanism in place to mark when Federal Student Aid recipients "begin attendance in a course." UT Arlington instructors will report when students begin attendance in a course as part of the final grading process. Specifically, when assigning a student a grade of F, faculty report the last date a student attended their class based on evidence such as a test, participation in a class project or presentation, or an engagement online via Blackboard. This date is reported to the Department of Education for federal financial aid recipients.

Attendance will follow university rules. Attendance will be taken at the beginning of each class period. Attendance will be considered in the final grade.

Use of Electronic Devices

Cell phone use in class is prohibited. Operation or use of a cellphone, except for electronic attendance, will result in the student being dismissed from the class for that day.

Expectations for Out-of-Class Study:

Beyond the time required to attend each class meeting, students enrolled MAE 4351, a 3-credit hour Capstone Design course, should expect to spend at least an additional 12-15 hours per week of their own time in course-related activities, including reading required materials, completing assignments, preparing for exams, etc.

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 University Catalog. For undergraduate courses, see <http://catalog.uta.edu/academicregulations/grades/#undergraduatetext>; for graduate courses, see <http://catalog.uta.edu/academicregulations/grades/#graduatetext>. For student complaints, see <http://www.uta.edu/deanofstudents/student-complaints/index.php>.

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/aao/fao/>).

Disability Accommodations: UT 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)*, *The Americans with Disabilities Amendments Act (ADAAA)*, and *Section 504 of the Rehabilitation Act*. 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 disability. Students are responsible for providing the instructor with official notification in the form of a **letter certified** by the Office for Students with Disabilities (OSD). Only those students who have officially documented a need for an accommodation will have their request honored. Students experiencing a range of conditions (Physical, Learning, Chronic Health, Mental Health, and Sensory) that may cause diminished academic performance or other barriers to learning may seek services and/or accommodations by contacting:

The Office for Students with Disabilities, (OSD) www.uta.edu/disability or calling 817-272-3364. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability.

Counseling and Psychological Services, (CAPS) www.uta.edu/caps/ or calling 817-272-3671 is also available to all students to help increase their understanding of personal issues, address mental and behavioral health problems and make positive changes in their lives.

Non-Discrimination Policy: *The University of Texas at Arlington does not discriminate on the basis of race, color, national origin, religion, age, gender, sexual orientation, disabilities, genetic information, and/or veteran status in its educational programs or activities it operates. For more information, visit uta.edu/eos*

Title IX Policy: The University of Texas at Arlington ("University") is committed to maintaining a learning and working environment that is free from discrimination based on sex in accordance with Title IX of the Higher Education Amendments of 1972 (Title IX), which prohibits discrimination on the basis of sex in educational programs or activities; Title VII of the Civil Rights Act of 1964 (Title VII), which prohibits sex discrimination in employment; and the Campus Sexual Violence Elimination Act (SaVE Act). Sexual misconduct is a form of sex discrimination and will not be tolerated. *For information regarding Title IX, visit www.uta.edu/titleIX or contact Ms. Jean Hood, Vice President and Title IX Coordinator at (817) 272-7091 or jmhood@uta.edu*

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 in their courses by 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. Additional information is available at <https://www.uta.edu/conduct/>.

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>.

Campus Carry: Effective August 1, 2016, the Campus Carry law (Senate Bill 11) allows those licensed individuals to carry a concealed handgun in buildings on public university campuses, except in locations the University establishes as prohibited. Under the new law, openly carrying handguns is not allowed on college campuses. For more information, visit <http://www.uta.edu/news/info/campus-carry/>

Student Feedback Survey: At the end of each term, students enrolled in face-to-face and online classes categorized as "lecture," "seminar," or "laboratory" are 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 via the SFS database is aggregated with that of other students enrolled in the course. Students' anonymity will be protected to the extent that the law allows. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback is required by state law and aggregate results are posted online. Data from SFS is also used for faculty and program evaluations. For more information, visit <http://www.uta.edu/sfs>.

Final Review Week: for semester-long courses, 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 <http://www.uta.edu/universitycollege/resources/index.php>.

The IDEAS Center (2nd Floor of Central Library) offers free tutoring to all students with a focus on transfer students, sophomores, veterans and others undergoing a transition to UT Arlington. To schedule an appointment with a peer tutor or mentor email IDEAS@uta.edu or call (817) 272-6593.

Library Home Page library.uta.edu

Resources for Students

Academic Help

Academic Plaza Consultation Services library.uta.edu/academic-plaza

Ask Us ask.uta.edu/

Library Tutorials library.uta.edu/how-to

Subject and Course Research Guides libguides.uta.edu

Subject Librarians library.uta.edu/subject-librarians

Resources

A to Z List of Library Databases libguides.uta.edu/az.php

Course Reserves pulse.uta.edu/vwebv/enterCourseReserve.do

FabLab fablab.uta.edu/

Special Collections library.uta.edu/special-collections

Study Room Reservations openroom.uta.edu/

Teaching & Learning Services for Faculty

Copyright Consultation library-sc@listserv.uta.edu

Course Research Guide Development, Andy Herzog amherzog@uta.edu or your subject librarian

Data Visualization Instruction, Peace Ossom-Williamson peace@uta.edu

Digital Humanities Instruction, Rafia Mirza rafia@uta.edu

Graduate Student Research Skills Instruction, Andy Herzog amherzog@uta.edu or your subject librarian

Project or Problem-Based Instruction, Gretchen Trkay gtrkay@uta.edu

Undergraduate Research Skills Instruction, Gretchen Trkay gtrkay@uta.edu or your subject librarian.

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 4351 – Aerospace Vehicle Design II

Spring Semester 2018

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Aerospace Vehicle Design II

MAE 4351

3 HOURS CREDIT

(2-LECTURE, 1-LAB)

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: 12 January 2018