AE6343-A/Q Aircraft Design I
Fall 2020 Syllabus

Course Instructor
Prof. Dimitri Mavris
dimitri.mavris@ae.gatech.edu
Office Hours: By appointment
Office: Weber 301

Teaching Assistants
Melek D. Ozcan & Luis Salas Nunez
mozcan7@gatech.edu & lesn3@gatech.edu
Phones: (404)894-8329 & (404)385-2777
Office Hours: TBD
Office: Weber 116

Introduction

This document provides basic information regarding the Aircraft Design I (FWD I) class for the Fall 2020 academic term. The course is listed as AE6343 for 3 credit hours in the course catalog of the Georgia Institute of Technology. Section A is for students on campus and section Q is for distance learning students. Students who are taking AE6343 Aircraft Design I should register for AE6383 Applied Design Laboratory concurrently. Please read the following information carefully.

Class Website

The official FWD I class website is on Canvas at https://canvas.gatech.edu/. This website is intended to provide all official lecture material, handouts, presentations, notices and relevant information. Note that the website will be constantly updated and must be checked on a regular basis. All announcements are automatically emailed to your GT student account. It is the student's responsibility to maintain access to this account and address email filtering issues. To log in use your GT account username (usually your first name initial followed by

your last name and a number, e.g., *gburdell3*) and your GT account user password. Once on Canvas, select the AE6343 course. Distance Learning students can access lecture videos through this website.

Class Schedule

Lectures take place every Friday, 2:00 pm to 4:45 pm. The lectures will be in Room 1 of the Weber Space Science and Technology (SST) building unless otherwise specified by the instructor or the teaching assistants. This course will offer lectures both in class and through broadcast recordings using classroom technology but will also bring smaller groups of students to the classroom on a predetermined basis with social distancing measures in place.

Calendar

The official school calendar of Georgia Tech is provided by the Office of the Registrar and is available at http://www.registrar.gatech.edu/home/calendar.php. Check this calendar for finals dates and times.

Class Objective

The main objective of the FWD I is twofold: First, to expose students to aerospace engineering material over all main areas and with enough detail and complexity so as to award a level of proficiency with which breadth and depth of concepts are adequately balanced. Secondly, for students to become skilled on the graduate level fixed wing design methods, approaches, concepts and tools presented using the aforementioned academic material background as a knowledge basis.

Course Textbook

The textbooks are available in the Georgia Tech Bookstore located at Technology Square as well as online book vendors and AIAA website:
Raymer, D. P., *Aircraft Design: A Conceptual Approach*, 6th Ed., Reston, Va.: AIAA, 2018.

Recommended References

These textbooks are recommendations for additional basic information on topics covered during the course:

- Anderson, J. D., *Fundamentals of Aerodynamics*, 6th Ed., Boston: McGraw-Hill Higher Education, 2016.
- Anderson, J. D., *Aircraft Performance and Design*, Boston: McGraw-Hill, 1999.
- Nicolai, L., Carichner G., *Fundamentals of Aircraft and Airship Design, Volume 1 - Aircraft Design*, AIAA, 2010.
- Nicolai, L., Carichner G., *Fundamentals of Aircraft and Airship Design, Volume 2 - Airship Design and Case Studies*, AIAA, 2013.
- Torenbeek, E., *Synthesis of Subsonic Airplane Design*, Delft University Press, 1982.
- Torenbeek, E., *Advanced Aircraft Design: Conceptual Design, Technology and Optimization of Subsonic Civil Airplanes*, John Wiley & Sons, Incorporated, 2013.
- Gere, J. M., Goodno, B., *Mechanics of Materials*, 8th Ed., Cengage Learning, 2012.
- Hill, P. G., Peterson, C. R., *Mechanics and Thermodynamics of Propulsion*, 2nd Ed., Reading, Mass.: Addison-Wesley, 1991.
- Mattingly, J., Heiser, W., Boyer, K., Haven, B., Pratt, D., *Aircraft Engine Design*, 3rd Ed., AIAA, 2018.
- Nelson, R. C., *Flight Stability and Automatic Controls*, 2nd Ed., Boston, Mass.: McGraw Hill, 1998.

Exams

There will be two take–home exams in this course. Students will have one week to submit their exams. The first take–home exam will tentatively be released on **October 9**. The second take-home exam will tentatively be released on **November 13**. The policy of the class is that any material covered during lecture or included in any official class document or within any of its projects or assignments may be used for questioning in exams.

Class Projects

There are two class projects that will address material covered in lectures and give hands-on experience on design methodologies and tools. The first project will tentatively be due on **October 2** and the second project will be tentatively due on **November 13**. These projects are described in handouts that will be provided to the class. A third short project, referred to as "Things you Should Know", will require that students conduct research on a basic topic in order to answer questions relevant to the field. Completion of this research and review of peer work composes this third project. Student will have the opportunity to evaluate

their team members' contributions through peer reviews in each of these projects. These evaluations will then be used to calculate the final project grades of each student. All other details including instructions and deliverables and will be provided in project description handouts.

Grade Breakdown

Take–home Exam 1	25%
Take–home Exam 2	25%
Project 1	20%
Project 2	20%
TYSK	10%

Class participation is encouraged and will be taken into account for the students on the borderline grades.

The following scale relating numeric to letter grades will be used for the entire course:

A 90%–100%

B 80%–89%

C 70%–79%

D 60%–69%

F 0%–59%

Student Expectations

Class Material Documents

Students are expected to complete reading assignments before lectures. It is the student's responsibility to understand the material to the best of his/her abilities before the lecture; the student may use the class material documents and any additional sources necessary. If a student is new to a certain topic it is his/her responsibility to become familiar with it outside lecture time. Class assistants will be available to help students in directing them to recommended sources and material.

Lectures

Students are expected to participate in the lecture discussions and to ask questions whenever in doubt about class material. Lectures are performed in a discussion type atmosphere where consistent questioning of concepts takes place and student engagement is crucial.

Honor Code

Students are expected to abide by the Honor Code of the Georgia Institute of Technology. Honor Code can be found at http://www.honor.gatech.edu/.

It is the responsibility of the students to become familiar with the Honor Code and be aware of rules and expectations. If you have any questions regarding the Honor Code please contact a representative of the Honor Advisory Council of the Institute. Violations to the Honor Code have serious consequences and will be enforced at all times.

Students with Special Needs

Your experience in this class is important to us. If you have already established accommodations with the Office of Disability Services, please communicate your approved accommodations to the instructor at your earliest convenience to discuss your needs in this course.

If you have not yet established services through Disability Services, but have a temporary health condition or permanent disability that requires accommodations (conditions include but not limited to; mental health, attention-related, learning, vision, hearing, physical or health impacts), please contact the Office of Disability Services at (404)894-2563 or `dsinfo@gatech.edu`.

Disability Services offers resources and coordinates reasonable accommodations for students with disabilities and/or temporary health conditions. Reasonable accommodations are established through an interactive process between you, your instructor(s) and Disability Services. It is important to the Georgia Institute of Technology to create inclusive and accessible learning environments consistent with federal and state law.

Health and Well-Being

Georgia Tech and the School of Aerospace Engineering understand that many students experience stress through a variety of academic, financial and personal experiences. We value you and want to make you aware of resources available to you should you need them. Your well-being and mental health are important, and we are here for you.

- Center for Assessment, Referral and Education (CARE)
- Campus Police (any emergency): 404-894-2500
- Counseling Center: 404-894-2575
- Dean of Students Office: 404- 894-6367

- Georgia Crisis and Access Line: 800-715-4225
- National Suicide Prevention Lifeline: 800-273-TALK (8255)
- Crisis Text Line: Text HOME to 741741
- VOICE: Victims Survivor Support: (404) 385-4464 (or 4451)
- Stamps Health Services

Class Contents

1. Introduction & Syllabus Review
2. Requirements analysis and concept down-selection
    (a) Definition of requirement, constraints, analysis, etc.
    (b) What is a good requirement?
    (c) How to map requirements to system design
    (d) How requirements are currently analyzed
3. Constraint and mission analysis
    (a) Mattingly's Energy Equation
        i. Introduction
        ii. Assumptions
        iii. Sample scenario evaluation
    (b) How mission analysis is currently performed
    (c) How to relate constraints to requirements
    (d) How to identify feasible design space
    (e) What to do if design space is over constrained
4. Performance
    (a) Simplified equations of motions of aircraft in flight
    (b) Typical performance characteristics:
        i. Cruising speed
        ii. Cruising altitude
        iii. Range and Endurance
        iv. Rate of climb, service ceiling, absolute ceiling, etc.
        v. Stall

(c) Control surfaces and their effects on performance

(d) Comparing performance of different engine types

5. Aerodynamics

   (a) Overview of basic parameters including:

      i. Lift, drag, aerodynamic center, center of pressure, etc.

      ii. Subsonic vs. transonic vs. supersonic vs. hypersonic

      iii. Lifting line theory, panel method, etc.

   (b) Introduction to the standard atmosphere

   (c) Effects of:

      i. Wing/body design

      ii. Engine type used

      iii. Body configuration

6. Propulsion

   (a) Types of propulsion systems

   (b) Sizing an engine

   (c) General engine trends (e.g., pressure, velocity, and temperature)

   (d) Brayton Cycle Analysis

   (e) Efficiencies

A Schedule

The following summarizes important deadlines throughout the semester.

Table 1: Tentative Course Schedule

Week	**Date**[1]	**Submit**
1	Aug 20 (Thu)	First Class (online)
4	Sep 11 (Fri)	Project 1 Release
7	Oct 2 (Fri)	Project 1 Deadline
8	Oct 9 (Fri)	Take–home Exam 1 Release
9	Oct 16 (Fri)	Take–home Exam 1 Deadline
10	Oct 23 (Fri)	Project 2 Release
13	Nov 13 (Fri)	Project 2 Deadline & Take–home Exam 2 Release
14	Nov 20 (Fri)	Take–home Exam 2 Deadline

[1]Reminder: These dates are tentative. Any changes will be promptly communicated by the Teaching Assistants.