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AE6333 Syllabus

Rotorcraft Design I, 3 Graduate Credits

General Information

Description

Stochastic approach to conceptual design of aerospace systems with emphasis on Rotorcraft. Comprehensive methodologies for aerospace vehicle synthesis and sizing. Integration of technologies.

Pre- &/or Co-Requisites

Graduate standing. It is recommended that this course and AE4071/8803 Rotorcraft Aeromechanics be taken concurrently if the student has no prior coursework in rotary-wing aeromechanics.

Many of the assignments require use of Matlab, therefore familiarity with Matlab and numerical programming is assumed.

Course Goals and Learning Outcomes

The course exposes students to different rotary-wing air vehicle design techniques, including traditional rotorcraft, unmanned aerial vehicles (UAV), and urban/advanced air mobility (UAM/AAM) and allows them to apply these techniques to vehicle design in a team-oriented environment. The objectives are:

a) to familiarize the students with traditional design techniques and applications
b) to teach students modern design theory and techniques
c) to allow the student to apply the methods learned to the design of a vehicle, including sizing, synthesis, and analysis.

Course Requirements & Grading

Assignment	Date/Information	Percentage Weight
Homework, Case Studies	5 assignments[1]	36%
Individual Midterm Project	Midway through semester	32%
Final Team Project	Last week of class	32%

Extra Credit Opportunities

Extra credit assignments may be presented to the class at the discretion of the instructor.

Description of Graded Components

Homework and Case Studies: Various individual assignments and case studies to demonstrate knowledge of material introduced in lectures. These may include case studies, as well as development of computational routines that will be integrated into the midterm and/or final project assignments.

Midterm Project: The individual midterm project will consist of an element of conceptual design of a vehicle defined in class, including verification and validation elements. The midterm project is completed individually without consultation with other students or persons outside of class.

[1] Nominally 5 assignments, but the number of assignments will be at the discretion of the instructor and may include fewer or more assignments. The total weighting of this element in the course grade will not change

Final Project: The team final project will consist of the conceptual design and sizing of a rotary-wing vehicle define in class. The final project will be assigned after the midterm and will be due on the final day of class. The project will consist of a written report included code elements, as appropriate, as well as a briefing to the class on the final class day.

Grading Scale

The final grade will be assigned as a letter grade according to the following scale:

A	90-100%
B	80-89%
C	70-79%
D	60-69%
F	0-59%

Full credit is awarded for solutions that are correct and demonstrate an understanding of the concepts of the problem. Partial credit is given for solutions that, while incorrect, demonstrate some knowledge of the concepts.

Course Materials

Course Text

Required Text: Leishman, *Principles of Helicopter Aerodynamics*, Cambridge University Press, 978-1107013353[2] (See important footnote) Reading and homework will be assigned from this text.

Additional Materials/Resources: Professor notes and handouts.

The following textbook and depositories may be helpful as optional references for this course:
Johnson, *Rotorcraft Aeromechanics*, Cambridge University Press, 978-1107606913 (See footnote)

Numerous titles from the NASA Technical Report Server (https://ntrs.nasa.gov) and at GT SmarTech depository (https://smartech.gatech.edu/) and the NASA Aeromechanics Website (https://rotorcraft.arc.nasa.gov/Publications/2022.html)

Course Website and Other Classroom Management Tools

Course materials will be posted online to Canvas (https://canvas.gatech.edu/). Course materials (e.g. recorded videos) will be available to both in person and distance learning sections. Important communications to the class will be sent through the Canvas system; please be alert to these messages. Students will be held responsible for any message or announcement that has been posted to the class for 24 hours or longer.

We will be using Piazza for discussion outside of class. The system is highly catered to getting you help fast and efficiently from classmates, the TA (if assigned), and myself. Rather than emailing questions to the teaching staff, I encourage you to post your questions on Piazza. If you have any problems or feedback for the developers, email team@piazza.com.

Course Expectations & Guidelines

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit http://www.catalog.gatech.edu/policies/honor-code/ or http://www.catalog.gatech.edu/rules/18/.

[2]There are no "free" internet downloads of these two textbooks available. Download of a pdf book from any internet site is a copyright violation which is not only a violation of engineering ethics and the GT honor code, it is a federal criminal act. Any instances I find will be reported. Don't jeopardize your career to save a few dollars; if you are in need, please see me for help.

Students are required to report any suspected violation of the Honor Code to the Instructor whether or not they were directly involved in the incident.

Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404)894-2563 or http://disabilityservices.gatech.edu/, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Attendance and/or Participation

Classroom attendance, either in person or remotely, is strongly encouraged, though not required. Active participation is essential for understanding major concepts and contributing to the learning of others.

Absences related to personal illness or emergency, or career development (e.g. presenting a paper at a conference or scheduled job interview) are considered excused. Please contact the instructor as soon as you know of a schedule conflict if this applies to you.

Collaboration & Group Work

Discussions with other students about how to solve homework problems are allowed and encouraged; however, all work turned in must be the student's own original work.

The use of outside references (e.g. textbooks) is expected and encouraged; however, students must appropriately cite (including page, figure, equation number, as appropriate) any referenced material that is used.

Use of homework solutions from prior semesters (if/when applicable) is not allowed.

The midterm project intended to measure the learning of individual students; therefore receiving assistance from individuals other than the instructor is not allowed.

Extensions, Late Assignments, & Re-Scheduled/Missed Exams

Assignments are due at the designated time using online submission on Canvas. Any assignment turned in after this time is late. Students have three (3) discretionary 24-hour late passes for assignments other than projects. Students may use at their discretion without asking for permission. The late passes include weekend days. Any assignment turned in after the use of the 3 passes will not be counted.

Students in a distance learning section will receive a standard 1-week delay on all assignments other than the final team project. This delay includes the individual midterm project.

Excused absences (see above) may be a justification to receive an extension on an assignment or to re-schedule an exam. Please contact the instructor as soon as you know of a schedule conflict if this applies to you.

Student-Faculty Expectations Agreement

At Georgia Tech we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. See http://www.catalog.gatech.edu/rules/22/ for an articulation of some basic expectation that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Student Use of Mobile Devices in the Classroom

Mobile Devices (laptop computers and tablets) may be used in class to enhance your learning experience, provided they are used in support of the class and are not a distraction to you or your classmates. Viewing materials unrelated to the class and doing homework in class is not allowed. Cell phones should be set to silent mode during class. If you must answer a phone call during class, please step outside so as not to disturb the class.

Additional Syllabus Components

Honesty:

The School of Aerospace Engineering values honesty and integrity of all members of our community. An important element of this value is the academic honor code.

Georgia Tech Honor Challenge Statement: I commit to uphold the ideals of honor and integrity by refusing to betray the trust bestowed upon me as a member of the Georgia Tech community.

Honor Code: http://policylibrary.gatech.edu/student-affairs/academic-honor-code#Article_I:Honor_Agreement

Well Being:

The School of Aerospace Engineering values the complete well-being of all members of its community, which includes professional, physical, spiritual, emotional, and social dimensions. There are numerous resources to support the health and well-being of all members of our community: https://gatech.instructure.com/courses/108574

Mental Health Resources:

Emergencies: Can either Call 911 or call Campus Police at 404.894.2500 http://www.police.gatech.edu/
Center for Assessment, Referral, & Ed. (CARE): https://care.gatech.edu/ 404.894.3498 (Counselor On-Call)
Counseling Center: https://counseling.gatech.edu/ 404.894.2575
Stamps Health Services: https://health.gatech.edu/ 404.894.1420
Student Life and Dean of Students: https://studentlife.gatech.edu/content/get-help-now 404.894.6367
Victim-Survivor Support (VOICE): https://healthinitiatives.gatech.edu/well-being/voice 404-385-4464/(or 4451)
National Suicide Prevention Lifeline: 1.800.273.TALK (8255)
Georgia Crisis and Access Line: 1.800.715.4225

Social Justice:

The School of Aerospace Engineering values social justice for all members of the Georgia Tech community and the larger society. Social justice means that everyone's human rights are respected and protected. We stand committed in the fight against racism, discrimination, racial bias, and racial injustice. Our shared vision is one of social justice, opportunity, community, and equity. We believe that the diversity and contributions from all of our members are essential and make us who we are. We believe that our impact must reach beyond the classroom, research labs, our campus, and the technology we create, but must also improve the human condition where injustice lives. We will continue to work to understand, value, and celebrate all people and create an inclusive educational and work environment that welcomes all.

As a matter of policy, Georgia Tech is committed to equal opportunity, a culture of inclusion, and an environment free from discrimination and harassment in its educational programs and employment. Georgia Tech prohibits discrimination, including discriminatory harassment, on the basis of race, ethnicity, ancestry, color, religion, sex (including pregnancy), sexual orientation, gender identity, national origin, age, disability, genetics, or veteran status in its programs, activities, employment, and admissions.

http://policylibrary.gatech.edu/equal-opportunity-nondiscrimination-and-anti-harassment-policy

Course Schedule

The following outline lists the topics to be covered in the course and tentative dates for exams. Due to travel commitments and other unanticipated events, the instructor reserves the right to modify the sequence of course topics taught, assignments associated with topics, and project dates. These will be communicated in class or via email/Canvas.

Unless noted otherwise, assignments will typically be due one week after assigned.

The class time is three hours, but this is far too long for a lecture course. The class will proceed with lectures 1 to 1.5 hours in length (varies with class topic) with a 10-20 minute break. After the break the lectures will continue for a second 1 to 1.5 hours to complete the defined class time.

Lecture	Date	Topic	Assignments
1	8/26	Introduction: Design, Rotary Wing Vehicles	
2	9/2	Cert/Qual Requirements; Requests for Proposals	1
3	9/9	Sizing and Synthesis - Part 1	
4	9/16	Sizing and Synthesis – Part 2	2
5	9/23	Performance – Part 1	Midterm set
6	9/30	Performance – Part 2	3
7	10/7	Weight & Balance, Rotor Blade Design – Part 1	
8	10/14	Rotor Blade Design – Part 2	
9	**10/21**	Electric Propulsion	**Midterm due**
10	10/28 (Drop Day)	Component Design – Part 1	4, Final set
11	11/4	Component Design – Part 2	
12	11/11	Component Design – Part 3	5
13	11/18	Stability and Control in Conceptual Design	
14	11/25	No class – Thanksgiving Break	
15	**12/2**	**Final Project Presentations and Reports**	**Final due**