AE4071 and AE8803 (RAL/QRA) Syllabus

Term: Fall 2026

AE4071 - Rotorcraft Aeromechanics, 3 Undergraduate Credits

AE8803 – Rotorcraft Aeromechanics, 3 Graduate Credits

Instructor Information

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General Information

Description

This is the basic/introductory rotorcraft course offered at Georgia Tech and it should be taken by any student that is interested in rotorcraft and wants to lay a foundation for future work in rotorcraft. The aim is to provide students with a basic understanding of rotor aerodynamics and dynamics, how rotors and rotorcraft work, derive and teach the fundamental rotor theories, calculate helicopter performance, trim, and introduce rotor dynamics and rotor controls.

Pre- &/or Co-Requisites

AE4071: AE3030 Steady Fluid Mechanics and/or Aerodynamics at the undergraduate level
AE8803: Graduate standing.

Both: Although mostly "hand calculations," some of the assignments may require use of Matlab or other computational tools, and some familiarity with numerical programming is assumed.

Course Goals and Learning Outcomes

Students will be able to model the rotor as an actuator disk/line/blades; compute rotor aerodynamic forces and moments; perform rotorcraft vehicle performance analysis; develop simplified rotor inflow models; formulate and analyze rigid blade dynamics; understand introductory aspects of rotorcraft stability, control and vibration.

Course Requirements & Grading

Assignment	Information	Percentage Weight
Homework	Monthly; 3 individual HW, all worth the same; possible 4th HW for extra credit	50%
Midterm	Date will be set in class, a minimum of one week in advance. Efforts will be made to deconflict with midterms of other classes	20%
Final	See official GT finals schedule	30%

Extra Credit Opportunities

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

Description of Graded Components

There will be different, though in some cases, overlapping graded components for the undergraduate AE4071 and the graduate AE8803 sections. There will be different exams, and homework assignments will have additional components.

Unless otherwise noted, all graded components will be individual assignments. Mid-term and the final will be timed and in-person (for DL section: Honorlock online exam management system is used; students are responsible to satisfy the technical requirements for the Honorlock system), unless health and safety circumstances require otherwise.

Grading Scale

Your 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. Even if the final answer is correct, if the path getting to this result is not understandable, only partial credit may be given.

Course Materials

Course Text

Required Text: Leishman, *Principles of Helicopter Aerodynamics,* Cambridge University Press, 978-1107013353[1] (See important footnote). Since the class hours are not enough to cover all material that is needed to solve the homework and/or exam problems, reading up on certain topics/sections of the book is needed to solve the homework and/or exam problems.

Additional Materials/Resources: Professor notes and handouts.

The following textbook may also be helpful as optional references for this course. Pdf is available for free via the Georgia Tech Library.
Johnson, *Rotorcraft Aeromechanics*, Cambridge University Press, 978-1107606913

Course Website and Other Classroom Management Tools

Course materials will be posted online to Canvas (https://canvas.gatech.edu/) and/or communicated directly by the Teaching Assistant. Live stream and recorded videos will be available to distance learning sections only. Important communications to the class will be sent through the Canvas system; please be alert to these messages.

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. Review Georgia Tech's Honor Code and the student Code of Conduct.

[1]There are no "free" internet downloads of this textbook available (I know the author and checked!) 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 will be reported.

Any student suspected of cheating or plagiarism 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.

AI Policy and Collaboration

There are multiple types of AI, and they have very different policies. Most fall under the category of Generative AI. If you unsure of the AI usage or want to apply AI in a manner not described in the policy stated here, please check with the faculty instructors before using

In general, inclusion of anything you did not write yourself in your assignments (prose or math or code) without proper citation will be treated as an academic misconduct case. If you are unsure if you have gone too far consider these two simple guidelines: (1) avoid hitting *copy* in a conversation with an AI assistant; (2) do not have both your assignment and the AI agent open at the same time.

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

Technical writing and figure generation using AI programs, such as, but not limited to ChatGPT and Copilot, is a violation of the Honor Code. This course is designed to also develop professional level skills in writing, coding, and analysis, so all work you submit must be your own. You should never include in your assignment anything that was not written directly by you without proper citation (including quotation marks and in-line citation for direct quotes). Avoid using tools that directly add content to your submission.

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 is strongly encouraged, though not required. Since we often discuss technical aspects in class, and these might not be written on the board, active in-person participation is essential for understanding major concepts and contributing to the learning of yourself and others. Livestream and video recordings are only available for the distance learning section, not for the in-person campus sections.

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

All homeworks are individual assignments and group work is not allowed for these. 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 quizzes and final intended to measure the learning of individual students; therefore receiving assistance from individuals during these examinations is not allowed.

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

Assignments are due at the designated time using online submission (typed, written, or scanned pdf) on Canvas or to Teaching Assistant (will be communicated in class). Any assignment turned in after collection is late. There are no late submissions (no partial points) or extensions, except for extraordinary circumstances.

Recognizing that DL students are mostly working professionals and their work scheduled might not always allow timely submission, students in a distance learning or GT Europe section can expect lenience on the deadlines for handing in the homework. This must be properly communicated in advance. Arrangements can be made for quizzes and finals to accommodate work schedule (if needed).

Excused absences (see above) may be a justification to receive an extension on an assignment or to re-schedule an exam. 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. The Student-Faculty Expectations articulate some basic expectations 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.

Course Schedule

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

Topic	Approx. Class Hours
1. Introduction • Course introduction • A brief history of rotorcraft; how does a rotorcraft work? • Terminology, classes and types of rotorcraft • Importance of aeromechanics	**4**
2. Aerodynamics of rotors in hover, axial, and forward flight • Momentum theory in hover and forward flight • Blade element theory (BET) • Combined blade element momentum theory (BEMT)	**14**
3. Performance analysis • Hover performance • Climb and descent performance • Performance in forward flight • Autorotation	**9**
4. Physical Concepts of blade motion and control • Flapping, lead-lag, and feathering • Collective and cyclic controls • Steady-state flapping motion to control inputs • Steady-state flapping motion to body angular rates	**8**
5. Simplified trim analysis • Rotor forces and moments • force and moment balance • Trim solutions	**4**
6. Introduction to stability, control, and vibration (optional, because also taught in more depth in the class Helicopter Stability and Control by Prof. Prasad) • Pitch, roll, and yaw damping • Control power and control sensitivity • Static stability • Dynamic modes in hover • Vibration and methods for vibration control	**4**
Quiz/Exam	**2**
Total	**45**