Spacecraft Flight Dynamics

Course Information

Instructor: Koki Ho (kokiho@gatech.edu)
Course Prefix and Number: AE 4532
Term: Fall 2026

Course Description

This course will introduce the basic concepts for understanding orbits and how spacecraft orbit around planets and/or in the vicinity of one another, will learn what affects their stability, and how their motion can be estimated and controlled.

Course Learning Outcomes

This course will offer basic concepts of how spacecraft orbit around planets and/or in the vicinity of one another and what affects their stability. Throughout this course, students will develop an ability to formulate and solve flight dynamics problems through understandings of the following topics:

- Two-body problem
- Orbital elements
- Orbital transfers
- Interplanetary trajectory
- Kinematics
- Attitude dynamics
- Gravity gradient
- Advanced topics related to spacecraft orbital and attitude dynamics

Required Course Materials

Required Texts

- None.

Recommended Texts

- Spaceflight Dynamics, 3rd Ed., by W. Wiesel, 2010.
- Orbital Mechanics, 2nd Ed., by J. Prussing and B. Conway, 2012
- Fundamentals of Astrodynamics, 2nd Ed., by R. Bate, D. Mueller, J. White, and W. Saylor, 2020.
- Orbital Mechanics for Engineering Students, 4th Ed., by H. Curtis, 2020.

- Analytical Mechanics of Space Systems, 4th Ed., by H. Schaub and J. Junkins, 2018.

Grading Policy

10% Homework
30% Midterm exam 1
30% Midterm exam 2
30% Final exam

A 90-100; B: 80-90; C: 70-80; D: 60-70

Attendance Policy

This will be an active classroom, where you will be expected to participate.

Academic and Research Honesty/Integrity Statement

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 the Student Code of Conduct and the Academic Honor Code, especially Appendix A: Graduate Addendum to the Academic Honor Code.

Students are expected to perform research in an ethical and responsible manner. All Doctoral and Master's Thesis students are required to take the Responsible Conduct of Research training, and it is expected that students abide by the principles taught in that training while performing research for this thesis course.

Allegations of scientific or scholarly misconduct are handled in accordance with the procedures outlined by the Policy for Responding to Allegations of Scientific or Other Scholarly Misconduct.

Core IMPACTS

Not applicable.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services 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.

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.

Homework Policy

Assignments and their (partial) solutions will be posted on CANVAS. The grades will be based on submission only (i.e., submission of homework before the due date will give you full credit). If you have questions about the homework problems, please send an email to both the instructor and the TA.

A number of homework problems will need MATLAB, and no MATLAB codes will be provided as part of the solutions. You are expected to build your own MATLAB functions to solve various spacecraft flight mechanics problems, and you are allowed to use the developed MATLAB codes for the exams (see Exam Policy).

Homework is due by 11:59 pm ET on the indicated due date. All homework submissions will be on CANVAS (no in-class submissions). No late submissions will be accepted.

Exam Policy

The two midterm exams will be open-book take-home exams with a 24-hour window using the CANVAS system. You can refer to the textbook, notes, online materials, etc. and you can also use your computer (including the MATLAB codes) if needed.

If you choose to use MATLAB in the exam, please describe your approaches in your submissions for every problem to the extent that we can replicate your steps without checking your codes; we will not check the codes (or their PDF printout) for grading. For any problem in the exams for which you use MATLAB, please submit all your codes (i.e., all functions) you used together with your submission. All codes used in the exam have to be created by yourself; copying and pasting others' codes will be considered cheating.

No collaboration is allowed until the exam window is over for all sections; you are not allowed to discuss with others or attempt to use any homework help service like Chegg.

Please prepare the equipment to scan the exam submissions (a phone camera is allowed if the resolution is sufficiently high) so that you can submit the digital version before the deadline. No late exam submissions will be accepted.

The final exam will be an in-person closed-book exam according to the institution's published exam matrix. It will be cumulative and cover all topics learned in class.

Policy on Artificial Intelligence (AI) use

Artificial Intelligence (AI) may not be used for midterm or final exams. AI use is permitted for homework sets because they are not graded.