

AE 4321 Space Systems Design I (Credits: 3)

M/W 2-2:50 pm Success Center 152 (Lecture)

M 3:30-6:15 pm Clough UG Learning Commons 144 (Lab)

Instructor Information

Instructor

Hiro Ono

Email

ono@gatech.edu

Drop-in Hours & Location

Wed 4-5 @ Guggenheim 341

Teaching Assistant(s)

Sachin Kelkar

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How to contact us: 1) post your question on Ed Discussion, 2) talk to us before or after labs/lectures, or 3) send us an email, which could take >24 hours for a response.

General Course Information

Catalog Description

Spacecraft subsystems and synthesis. Students apply mission and spacecraft design principles. AE students may receive credit for only one design sequence.

Pre- &/or Co-Requisites

Pre-requisite: AE3330 Introduction to Aerospace Vehicle Performance

Course Goals and Learning Outcomes

Upon completion of this course, the student should be able to:

- Write and understand detailed aerospace system requirements
- Effectively communicate technical information in both oral and written formats
- Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
- Recognize ethical and professional responsibilities in engineering situations and make informed judgments
- Understand systems engineering concepts and terminology
- Conduct system sizing analyses and trade studies
- Understand spacecraft subsystems design trades individually and as a complete system
- Perform space mission subsystem designs and analyses

Course Requirements & Grading

Grades will be based on lab assignments, quizzes, and participation. The class does not have a final exam.

Assignment	Date	Weight (Percentage)
Lab Assignments	Assignments due every week	60%
Quizzes	Paper-based submissions due at the end of (almost) every lecture	15%
Final Project	End of semester	25%

Extra Credit Opportunities

Extra credit may be available on a case-by-case basis.

Description of Graded Components

Lab/Homework Assignments: Consists of weekly lab assignments which are due throughout the semester. Each assignment will be based on a worked lab using subject material covered in class that week. The required lab portion is instructional in nature, is individually completed, and is meant to be completed during the weekly lab class. Most lab assignments will be done during the lab period, although some assignments needing more time may have extended due dates. Completed lab assignments will be submitted via Canvas. Use proper units when appropriate. Deductions will be made for improper lab assignment format. In-person participation is required.

Quizzes: Quizzes at (almost) every lecture. A hand-written bubble sheet due at the end of lecture. Questions are mostly from the lecture of that day. Sometimes from the reading materials.

A final project will be developed towards the end of the semester to synthesize the material learned in the labs in a “Step 1” proposal. Details of the format, content, and assessment of this final project will be provided in early November.

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% or prohibited use of AI

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. Final grades may be curved based on overall class performance.

Course Materials

Course Text

Required Text: Wertz, J., Everett, D., Puschell, J., Space Mission Engineering: The New SMAD, Microcosm, 2011.

Reading will be assigned weekly. Although we don’t enforce or check, reading is a vital component for your learning and important for understanding lectures/lab.

Course Website and Other Classroom Management Tools

The course is managed via Canvas course number 542012 available at:

<https://gatech.instructure.com/courses/542012>

We may also use Microsoft Teams or Box/OneDrive/Sharepoint for communication and file sharing. Students may also require access to a webcam, microphone, and internet connection (to facilitate group work and selected online activities).

Course Policies, 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](#).

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](#) (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please contact the instructors at any time (and as early as possible) to set up a time to discuss your learning needs.

Attendance and/or Participation

Classroom attendance, either in person or remotely, is strongly encouraged and is part of your class grade. 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. Please see the Institute Absence Policy - <https://catalog.gatech.edu/rules/4/> for more information.

Collaboration, Group Work, and Use of Generative AI

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; when appropriate cite any referenced material that is used.

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

Allowable use of Large Language Models (LLMs) such as ChatGPT or other AI-writing tools is assignment-specific. Further guidelines will be provided. The general rule is *only* submit your own work:

Large Language Model (LLM) General Rule: All work you submit should be your own. Anything you submit should be written by you with proper citation. How to do this: 1) Never "copy" text from an AI assistant. 2) Recommendation: Do not have your assignment and the AI assistant open at the same time. *Credit:* David Joyner and Ron Mazique

This is an evolving area; while it is evolving, the above approach should be reasonably safe and will be acceptable for this course. Aside from this, using LLMs for learning is highly encouraged, armed with the knowledge that LLM output is imperfect.

A rule of thumb is that you may use AI for the things you are permitted to work with other students - e.g., having discussions, getting feedbacks, finding relevant literature, etc. You may not use AI for the things you are not supposed to do with other students - e.g., copying answers.

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

Homework assignments are due at the designated time using online submission on Canvas. Any assignment turned in after collection is late. Late homework assignments may be turned in during the advertised grace period (usually 48 hours) for half credit. Any homework turned in after this is not counted.

Excused absences (see above) may be a justification to receive an extension on an assignment. Please contact the instructor as soon as you know of a schedule conflict if this applies to you. Under special circumstances and at least two weeks of advance coordination with the professor, labs may be rescheduled for an individual. Labs missed due to illness or other emergencies can be made up but must be supported by appropriate documentation coordinated through the Dean of Students. The professor reserves the right to grant special dispensations when deemed appropriate.

Inclement Weather and Digital Learning Days

If weather-related events impact campus, the instructors have the discretion to cancel class or pivot to digital instruction (our nominal expectation in order to stay on schedule).

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 Course Policies

- Please contact the instructors regarding any accommodations for religious observances.
- Please contact the TA regarding any regrading requests.
- Video recording in the classroom is not permitted.

Additional Syllabus Components

Georgia Tech School of Aerospace Engineering Values



Integrity

I achieve excellence by embodying the highest ethical standards and communicating openly, authentically, and with humility.



Respect

I extend courtesy to everyone and promote a culture of inclusion, fairness, and equity.



Community

I am a global citizen and celebrate our collective achievements and contributions to the world around us.



Accountability

I take ownership of my actions and value the responsibility to honor public trust.



Adaptability

I embrace change as a path to progress, success, and innovation.

Discussion Points

1. **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

2. **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

3. **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 (tentative) topics to be covered in the course. Changes to the outline will be discussed in class, and updated versions will be uploaded as necessary to Canvas.

Week	Date (Mon)	Lecture	Lab	Date (Wed)	Lecture
1	24-Aug	Introduction and Course Logistics	—	26-Aug	NASA's Strategic and Science Plans
2	31-Aug	Mission Statement and Science Traceability Matrix	Mission Concept Design	2-Sep	Mission Architecture and Concept of Operations
3	7-Sep	Labor Day – No Class		9-Sep	Requirements
4	14-Sep	Space Design & Sizing	STM & CONOPS	16-Sep	V&V
5	21-Sep	Project Management, Scheduling, and WBS	Morph Matrix, requirements & WBS	23-Sep	Astrodynamics
6	28-Sep	Space navigation	Astrodynamics	30-Sep	Guest Lecture 1
7	5-Oct	Fall break – No class		7-Oct	Space Propulsion
8	12-Oct	Launch Vehicles	Propulsion	14-Oct	Space Environment I
9	19-Oct	Space Environment II	Space Environment	21-Oct	Entry, Descent, and Landing
10	26-Oct	Payload I	Entry, Descent, and Landing	28-Oct	Payload II
11	2-Nov	Guest lecture	Payload	4-Nov	Power
12	9-Nov	Communication I	Power and Comm	11-Nov	Communication II
13	16-Nov	Thermal and Structure	Spacecraft modeling	18-Nov	Attitude Determination and Control
14	23-Nov	Cost Modeling	Q&A for Final project	25-Nov	Thanksgiving – no classes
15	30-Nov	Ground ops	Q&A for Final project	2-Dec	TBD
16	7-Dec	Final project presentations			—

This course does not have a final exam.