



Department of Astronautical Engineering

ASTE 101 Fall 2024: Introduction to Astronautics

4 units

Lectures Mondays and Wednesdays 8:30-9:50 AM. Lab Tuesdays, 9:30-11:20 AM, Lecture: VHE 217. Lab: SAL 109

Instructor:

Dan Erwin, OHE 500W, 213-740-5358, erwin@usc.edu.

Office Hours: Mondays 10 AM - noon; Tuesdays 12 noon – 3 PM

Catalogue Description

Gateway to the major in Astronautical Engineering. Introduction to space, space exploration and the space business. Elements of orbits, spacecraft systems, rocket propulsion, and communications. Laboratory: Introduction to graphics, computation and simulation.

Course Description

This course is usually taken by Astronautical Engineering majors in their first year. It is a broad introduction not only to the field of astronautics but to engineering in general and how engineering differs from science.

Learning Objectives

After taking this course, the student will:

- ✦ Understand the importance of space in our society.
- ✦ Be able to write simple programs in Matlab and Python.
- ✦ Understand basics of the engineering software systems STK and NX.
- ✦ Understand the role of uncertainty and its effects on engineering design, manufacturing and control.
- ✦ Understand the key role of systems engineering in development of technological products.
- ✦ Understand the key elements of the GPS global constellation as an exemplar large-scale space enterprise.

Course Notes

This course uses several pieces of software:

- ✦ Matlab: A numerical computing language and environment
- ✦ Systems Toolkit (STK), a software package widely used in the space industry for designing, analyzing and visualizing space missions. STK is generously provided for use in the ASTE curriculum by the company, [Analytical Graphics Inc.](#)
- ✦ Siemens NX, a computer-aided design (CAD) package
- ✦ Python, a general-purpose programming language

Students can install these packages on their own machines or can use them via the [Viterbi Desktop](#).



Lab

The lab will start in the third week of classes, so the first lab meeting will be Tuesday September 10. The lab is primarily to allow increased instruction and group practice with the software packages covered in the course. It is also a resource for discussing and asking questions about homework and projects.

Description and Assessment of Assignments:

- ✦ **Homework:** Written homework assigned weekly and due in class on Wednesdays. Homeworks will be graded and returned, generally in one week. Homework solutions will be posted on the class website.
- ✦ **Projects:** Two projects will be assigned during the semester. These will be done in teams. For each project, one written report will be submitted by each team. The second project will also have a team oral presentation.

✦ **Final Exam:** There will be no final exam. The oral presentations for the final project will be given in the two-hour time slot scheduled by the University for the final exam.

Grading Breakdown

Homework, 40%

1st Project, 25%

2nd Project, 25%

Oral Presentation of 2nd Project, 10%

Week	Date	Topics	Software/Hardware
1	11/30 & 12/02	Importance and applications of space.	Introduction to Matlab.
2	12/07 & 12/09	Near-Earth space and the Solar System.	
3	12/14 & 12/16	Physics of spaceflight. Orbits.	Introduction to STK.
4	12/21 & 12/23	Electromagnetic propagation. Applications to communications and imaging.	
5	12/28 & 12/30	Rocket propulsion	NX design software.
6	01/04 & 01/06	Systems engineering.	
7	01/11 & 01/13	Errors and error propagation. Uncertainty in design.	Python programming
8	01/18 & 01/20	Control of engineered systems.	
9	01/25 & 01/27	Control methods and examples.	
10	02/01 & 02/03	Filtering and estimation.	
11	02/08 & 02/10	Filtering: Examples.	
12	02/15 & 02/17	Global Positioning System.	Examples of control using microcomputers
13	02/22 & 02/24	Ethical case study: Challenger explosion	
14	02/29 & 03/02	Spacecraft as autonomous systems	
15	03/07 & 03/09	New Space: Current space ventures and research efforts.	

Statement on Academic Conduct and Support Systems

Academic Conduct

Plagiarism — presenting someone else's ideas as your own, either verbatim or recast in your own words — is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in [SCampus](#) in Part B, Section 11, [Behavior Violating University Standards](#). Other forms of academic dishonesty are equally unacceptable. See additional information in [SCampus](#) and University [policies on scientific misconduct](#).

Support Systems

Counseling and Mental Health — (213) 740-9355 — 24/7 on call

<https://studenthealth.usc.edu/counseling>

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline — 1-800-273-8255 — 24/7 on call

<https://www.suicidepreventionlifeline.org>

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship & Sexual Violence Prevention Services (RSVP) — (213) 740-9355(WELL), press "O" after hours — 24/7 on call

<https://studenthealth.usc.edu/sexual-assault>

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED) — (213) 740-5086 | Title IX — (213) 821-8298

<https://equity.usc.edu>, <https://titleix.usc.edu>

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment — (213) 740-5086 or (213) 821-8298

https://usc-advocate.symplicity.com/care_report

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity |Title IX for appropriate investigation, supportive measures, and response.

The Office of Disability Services and Programs — (213) 740-0776

<https://dsp.usc.edu>

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Campus Support and Intervention — (213) 821-4710

<https://campussupport.usc.edu>

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC — (213) 740-2101

<https://diversity.usc.edu>

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency — UPC: (213) 740-4321, HSC: (323) 442-1000 — 24/7 on call

<https://dps.usc.edu>, <https://emergency.usc.edu>

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety — UPC: (213) 740-6000, HSC: (323) 442-1200 — 24/7 on call

<https://dps.usc.edu>

Non-emergency assistance or information.

Office of the Ombuds — UPC: (213) 821-9556, HSC: (323) 442-0382

<https://ombuds.usc.edu>

A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.