USC University of
Southern California

USC Viterbi
School of Engineering

Department of Astronautical Engineering

ASTE 101 Fall 2014:
Introduction to Astronautics

4 units
Lecture Monday and Wednesday 9:30-10:50, RTH 115
Lab Tuesday 8:30-9:50, SAL 126

Note: There will be no lab session the first two weeks. The first lab session will be Tuesday September 9.

Instructor:

Dan Erwin, RRB 222, (213) 740-5358, **erwin@usc.edu**.

Text: Jerry Jon Sellers, *Understanding Space: An Introduction to Astronautics*, 3rd ed. McGraw-Hill, 2005. ISBN 0-07-340775-5

Midterm Exams: Wednesday, October 1, in class. Wednesday, November 5, in class.

Final Exam: Monday, December 15, 11:00 AM-1:00 PM in the regular classroom.

Homework: Assigned weekly. Due on Wednesdays in class.

Grading: Homework, 25%; each midterm, 20%; final exam, 35%.

Software used:

Matlab: A general-purpose numeric computation environment, with some symbolic capability. An interpreted C-like language, extended with vector and matrix syntax, is coupled with mathematics and graphics libraries. The student who is comfortable with Matlab will be able to do numeric solution of any problem he or she is faced with, as well as provide graphical representation of the solutions. USC-ISD maintains Matlab on the student computing cluster. The student version of Matlab is a free download at **software.usc.edu**; while it is not necessary to have the program installed on the student's computer, it is very convenient. Matlab is used throughout the undergraduate curriculum, so installing it is highly recommended.

STK (Systems Toolkit): A package for setting up, simulating, and visualizing the operation of space missions. Launch, orbits and stationkeeping, attitude dynamics and control, communications, and ground station operations can all be simulated. ASTE has a site license for STK through a donation from the company, **Analytical Graphics Inc. (AGI)**. For instructions on how to install STK on your own machine, see **ASTE Licensing of Systems Toolkit**.

agi Software for Space, Defense & Intelligence.

Course Material:

The times and topics given below are approximate, and the list may change as the semester progresses. We will see how things go and take more or less time on each topic as seems appropriate.

Week	Date	Topic	Reading

1	08/25 & 08/27	Introduction to the space industry: communication, remote sensing, exploration. Unique characteristics of autonomous spacecraft. Demo of Matlab, STK. The universe and solar system. Time and units.	Ch. 1, 2
2	09/01 & 09/03	Intro to computation. Kepler's laws.	Matlab tutorials
3	09/08 & 09/10	Low Earth orbit (LEO) and geostationary orbit (GEO). Atmospheric layers. Space environment. Tidal forces. Vernal equinox vector. Matlab: Control flow; plotting.	Ch. 3
4	09/15 & 09/17	Intro to orbits. Energy and angular momentum. Approximations that lead to conic section orbits.	Ch. 4
5	09/22 & 09/24	Orbital elements. Euler and roll-pitch-yaw angles.	Ch. 5
6	09/29 & 10/01	Rotational transformations. Matrices. Solution of simultaneous equations. FIRST MIDTERM EXAM.	Ch. 5
7	10/06 & 10/08	Intro to graphics. Intro to STK. Orbital maneuvers: Hohmann transfer and plane change.	Ch. 6, sections 1, 2. STK tutorials.
8	10/13 & 10/15	Applications of Hohmann transfer. Hyperbolic trajectories. Flybys. Planetary escape. Intro to gravity assist.	
9	10/20 & 10/22	Matlab code for Hohmann transfer. Orbital rendezvous. Synodic period for interplanetary launch windows.	Ch. 6, section 3.
10	10/27 & 10/29	Interplanetary trajectories. Departure and arrival.	Ch. 7, secs. 1, 2
11	11/03 & 11/05	Gravity assist. Rocket propulsion. SECOND MIDTERM EXAM.	Ch. 7, sec. 3. Ch. 14, secs. 1, 2
12	11/10 & 11/12	Vehicle performance. Staging. Earth launch.	Ch. 14, sec. 3. Ch. 9
13	11/17 & 11/19	Spacecraft systems.	Ch. 13
14	11/24 & 11/26	Politics and economics of the space industry.	Ch. 16
15	12/01 & 12/03	Special topics. Review.	

Statement for Students with Disabilities

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (**DSP**) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to the instructor as early in the semester as possible.

DSP is located in STU 301 and is open 8:30 AM to 5:00 PM, Monday through Friday. Contact information:

- Phone: (213) 740-0776
- TDD only: (213) 740-6948
- FAX: (213) 740-8216
- Email: **ability@usc.edu**

Statement on Academic Integrity

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. *Scampus*, the Student Guidebook, contains the **Student Conduct Code**, while the recommended sanctions are located in **Appendix A** . Students will be referred to the **Office of Student Judicial Affairs** and Community Standards for further review, should there be any suspicion of academic dishonesty. The review process is described **here** .

Emergency Preparedness/Course Continuity in a Crisis

In case of a declared emergency, if travel to campus is not feasible, USC executive leadership will announce an electronic way for instructors to teach students in their residence halls or homes using a combination of Blackboard, teleconferencing, and other technologies.