ASTE 101

Fall 2017

Introduction to Astronautics

Lecture: Mon/Wed, 9:30 - 10:50 AM, RTH 115

Lab: Tue, 8:00 - 9:50 AM, SAL 126

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RRB 201
Office Hours: Before Class; Friday Mornings (text to confirm); Virtual
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NOTE: This syllabus may be updated throughout the course.
Refer to the online version as most up-to-date.

Course Description:
This course is meant to be an introduction to the Astronautical Engineering major and field of study, covering the following major topics: Introduction to space, space exploration and the space business; Elements of orbits; spacecraft systems and systems engineering; rocket propulsion; missions and applications such as communications and scientific observation; scientific computation using MATLAB and STK.

The laboratory section is required and will emphasis the scientific computation elements of the course. This course is required for the B.S. degrees in Astronautical Engineering (ASTE), and is typically taken in the first year.

Prerequisites: None.

Units: 4

What you should already know: High school math and physics.

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

Midterm Exams:
First: Wednesday, 10/4, regular class time; Second: Wednesday, 11/9, regular class time.

Final Exam:
Monday, 12/11, 11:00 AM - 1:00 PM, Room TBD.

Alternate Final Exam: TBD

Homework: Assigned weekly. Due on Wednesdays in class.
NOTE: Late homework will be accepted up to one week past the due date but will be reduced in grade by 50%. Exceptions to this must be approved by the instructor in advance of the due date.

Grade Distribution:

Homework	25%
Midterm Exam #1	20%
Midterm Exam #2	20%
Final Exam	35%

NOTE: Letter grade distributions are based on a curve and vary per semester.

Instructor Biography:
Professor Paul Giuliano is a Systems Engineer at NASAs Jet Propulsion Laboratory in Pasadena, CA, focusing on instrument systems and concepts for special applications. He holds an Adjunct Faculty position within the Department of Astronautical Engineering at the University of Southern California in Los Angeles, CA, teaching undergraduate programs in Astronautics and Space Technology.

In his spare time, Professor Giuliano consults for the film industry on matters of science and space technology and volunteers in the community by teaching elementary, middle, and high school level classes in science, technology, engineering, and math. Prior to joining NASA-JPL, Professor Giuliano was a Lead Systems Engineer within the Advanced Missions and Programs group of the Boeing Satellite Development Center in El Segundo, CA, working new business, technology development, strategy, and special projects for space technology.

He received his Ph.D. and M.S.E. in Aerospace Engineering and Plasma Science and Engineering from the University of Michigan, Ann Arbor, MI, specializing in the high-performance computation of plasma physics transport phenomena using statistical methods as applied to advanced in-space propulsion systems. Prior to that, he received a B.S. in Astronautical Engineering at the University of Southern California where he led teams in rocket propulsion and experimental plasma physics and held temporary research positions at Princeton University and Caltech/NASA-JPL.

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 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.

Discrimination, sexual assault, and harassment are not tolerated by the University. You are encouraged to report any incidents to the Office of Equity and Diversity or to the Department of Public Safety. This is important for the safety of the whole USC community. Another member of the University community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. The Center for Women and Men provides 24/7 confidential support, and the sexual assault resource center webpage describes reporting options and other resources.

Support Systems

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the American Language Institute, which sponsors courses and workshops specifically for international graduate students. The Office of Disability Services and Programs provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, USC Emergency Information will provide safety and other updates, including ways in which instruction will be continued by means of Blackboard, teleconferencing, and other technology.

Tentative Course Outline:
The weekly coverage might change as it depends on the progress of the class. However, you should keep up with the reading assignments.

Week	Date	Content	Reading
Week 1	8/21 & 8/23	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
Week 2	8/28 & 8/30	Intro to computation. Kepler's laws. Low Earth orbit (LEO) and geostationary orbit (GEO).	Ch. 3
Week 3	~~9/4~~ (Labor Day) & 9/6	Atmospheric layers. Space environment. Tidal forces. Vernal equinox vector.	Ch. 3
Week 4	9/11 & 9/13	Intro to orbits. Energy and angular momentum. Approximations that lead to conic section orbits.	Ch. 4
Week 5	9/18 & 9/20	Orbital elements. Euler and roll-pitch-yaw angles.	Ch. 5
Week 6	9/25 & 9/27	Rotational transformations. Matrices. Solution of simultaneous equations.	Ch. 5
Week 7	10/2 & 10/4	Intro to graphics. Intro to STK. Orbital maneuvers: Hohmann transfer and plane change. FIRST MIDTERM EXAM.	Ch. 6, STK
Week 8	10/9 & 10/11	Applications of Hohmann transfer. Hyperbolic trajectories. Flybys. Planetary escape. Intro to gravity assist.	Ch. 6
Week 9	10/16 & 10/18	MATLAB code for Hohmann transfer. Orbital rendezvous. Synodic period for interplanetary launch windows.	Ch. 6
Week 10	10/23 & 10/25	Interplanetary trajectories. Departure and arrival.	Ch. 7
Week 11	10/30 & 11/1	Gravity assist. Rocket propulsion.	Ch. 7
Week 12	11/6 & 11/8	Vehicle performance. Staging. Earth launch. SECOND MIDTERM	Ch. 14

Week 13	11/13 & 11/15	Spacecraft Systems. Missions and applications. Case studies.	Ch. 14
Week 14	11/20 & ~~11/22~~ (Turkey Recess)	Power, thermal, guidance, and other systems. Politics and economics of space.	Ch. 16
Week 15	11/27 & 11/29	Special topics. Final Exam review	TBD