ASTE 535: Space Environment and Spacecraft Interactions
Spring 2021

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Course Description

Space Environment and Spacecraft Interactions is an interdisciplinary course which provides a broad scientific and engineering background on the natural and induced space environments and their interactions with space systems. Topics covered include

1) Space Environments (The Space Environment of the Earth; Interplanetary Environment; Solar-Planetary Relationships; The Environments of the Moon and Asteroids; Space Weather; Micrometeoroid and Orbital Debris Environment; Induced Spacecraft Environment)
2) Space Physics and Plasma Physics Background (Gas Kinetic Theory; Electromagnetic Theory; Plasma Physics; Nuclear and Radiation Physics; Molecular/Atomic Collisions and Molecular/Atomic-Surface Interactions)
3) Spacecraft-Environmental Interactions and Effects (Vacuum Interaction; Atmospheric Interaction; Plasma Interaction/Charging; Radiation Interaction; Hypervelocity Impacts; Contamination)
4) Selected Topics on Interactions in Complex Environments, Mitigation Concepts, and Engineering/Design Practices (Electric Propulsion Plume Interactions; Dust Interactions/Astronaut Charging on Lunar Surface; etc.)

ASTE535 in the spring semester focuses more on the quantitative analysis and the physics.

Text

1) Lecture Notes and Handouts
2) *Spacecraft Environmental Interactions*, D.E. Hastings and H. Garrett, Cambridge University Press, 2004

Expectations

Honor Code: students are expected to follow the university honor code. You are encouraged to discuss homework assignments with your instructor, teaching assistant, and classmates. However, all work submitted for a grade must reflect your own understanding of the material. You may not copy answers to homework problems and you may not assist others or seek assistance on exams.

Attendance: students are expected to attend all classes either in person or remotely. Midterm and Final exams must be taken on-campus or at a monitored site as determined by DEN.

Homework Policy: There will be homework assignments approximately once per week. Homework must be turned in to me at the beginning of the lecture hour on the due date. *Late homework will not normally be accepted*.

Grades: grades will be determined by homework, and the mid-term and final exams.

Grading Policy:

Homework	35%
Mid-Term Exam	30%
Final Exam	35%

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Week	Subject	Lecture Notes	HWK Due
1 (1/19)	Course Introduction and Overview Space Environment/Effects Overview	Sec #0 Sec #1	
2 (1/26)	Introduction/Review: Gas Kinetics; Physical Gas Dynamics; Collisions	Sec #2	
3 (2/2)	Rarefied Gas-Surface Interactions Atmospheric Drag	Sec #3	#1
4 (2/9)	Review of Electromagnetism Introduction: Plasma Physics	Sec #4	#2
5 (2/16)	Plasma-Surface Interactions Current Collection, Charging	Sec #5	#3
6 (2/23)	Radiation Physics Radiation Environment	Sec #6	#4
7 (3/2)	Radiation Interactions Review	Sec #7	#5
8 (3/9)	**Mid-Term Exam (March 16th)**		#6
9 (3/16)	Midterm review Outgassing Spacecraft Contamination	 Sec #8	
10	**No Class (March 23)**		
11 (3/30)	MM&OD; Hypervelocity Impact The Earth's Space Environment Atmosphere, Ionosphere	Sec #9 Sec#10a,b	#7
12 (4/6)	The Earth's Space Environment Magnetosphere, Plasmasphere The Sun/Interplanetary Environment	 Sec#10c,d Sec#11a,b	#8
13 (4/13)	Lunar/Asteroid/Comet Environments Spacecraft Interactions on Planetary Body Surfaces	Sec #12	#9
14 (4/20)	Environmental Interactions Relevant to Human Exploration of the Moon Electric Propulsion Induced Spacecraft Interactions	Sec #13 Sec #14	#10
15 (4/27)	Intro. Laboratory and Simulation Techniques Review		#11
	Final Exam (USC exam schedule)		

(Schedule subjected to change)