

**San José State University**  
**Aerospace Engineering**  
**AE210 Advanced Space Systems Engineering, Fa11 2020**



<b>Instructor:</b>	Dr. Periklis Papadopoulos
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<b>Office Hours:</b>	T/TH 20:30 pm– 21:30 pm
<b>Class Days/Time:</b>	Mon 19:30 pm – 20:30 pm
<b>Classroom:</b>	Online
<b>Prerequisites:</b>	BSAE or instructor consent

**Course Description**

*The process of detailed design of bus and payload sub-systems of spacecraft will be studied in this course. The course will include topics on engineering design, design cycle and the phased approach in aerospace systems design. It will provide an overview of the engineering process used in aerospace mission and system design spanning the entire system life cycle for the near-Earth and outer space environment. Effects of gravity field, temperature and radiation on physical systems and the human physiology are some of the topics covered. Mission program inception, proposal development, and risk management will be studied.*

## Course Goals

Introduce students to:

- *Basic space systems engineering design practices*
- *Subsystem design and sizing*
- *System decomposition and integration principles*
- *Design optimization techniques*
- *Mission design principles and approach*
- *Understand PDR, CDR, FRR system requirements and design processes*
- *The analysis and optimization of multidisciplinary space systems during the conceive and design phases*

## Course Learning Outcomes (CLO)

Upon completion of this course students will be able to:

1. *Decompose a complex space system to its sub-systems*
2. *Perform design of space exploration studies*
3. *Develop elements of an aerospace system proposal, develop specifications, project planning and mission scheduling*
4. *Assess the impact of the mission space environment on the system design and operations*
5. *Provide descriptions of the various elements comprising a space system.*
6. *Expose the student to the challenge of the integration of space system elements.*
7. *Provide an in-depth exposure to at least one of the spacecraft subsystem groups.*
8. *Develop and codify a prescriptive approach to multidisciplinary modeling and quantitative assessment of new or existing system/product architectures*

## Required Texts/Readings

### Textbook

*Space Mission Analysis and Design, Wiley J. Larson, James R. Wertz*

### Other Readings

*Instructor Notes*

*Understanding Space: An Introduction to Astronautics, Jerry Joe Sellers, William J. Astore, Robert B. Giffen, Wiley J. Larson.*

*Fundamentals of Space Systems by Vincent Pisacane and Robert Moore, Oxford Press*

## Midterm & Final Project

- *You must average at least 70% on your midterm and final project to receive an A or a B in the course.*

## Grading Information

<i>Workouts</i>	<i>100 points</i>
<i>Homework</i>	<i>150 points</i>
<i>Attendance</i>	<i>50 points</i>
<i>Midterm Exam</i>	<i>300 points</i>
<i>Final Project</i>	<i>400 points</i>
<i>Total</i>	<i>1000 points</i>
<i>950 points &lt;</i>	<i>A+</i>
<i>900 points &lt;</i>	<i>A</i>
<i>850 points &lt;</i>	<i>A-</i>
<i>800 points &lt;</i>	<i>B+</i>
<i>750 points &lt;</i>	<i>B</i>
<i>700 points &lt;</i>	<i>B-</i>
<i>670 points &lt;</i>	<i>C+</i>
<i>650 points &lt;</i>	<i>C</i>
<i>600 points &lt;</i>	<i>D</i>
<i>Below 600 points =</i>	<i>F</i>

## University Policies

*Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' [Syllabus Information web page](http://www.sjsu.edu/gup/syllabusinfo/) at <http://www.sjsu.edu/gup/syllabusinfo/>.*

*AE Department and SJSU policies are also posted at <http://ae.sjsu.edu/program-policies>.*

## Course Schedule

Week	Date	Topics, Readings, Assignments, Deadlines
1	8/30	Introduction, Course Overview, Space Mission Analysis and Design
2	9/6	Space Environments
3	9/13	Space Environments / Systems Engineering Process
4	9/20	Mission Objectives, Design, Subsystems / Final Project Proposal Due
5	9/27	Design, Subsystems, System-level coupling and interactions
6	10/4	Design, Subsystems, System-level coupling and interactions
7	10/11	Systems Engineering Process, Mission Objectives, Design, Subsystems, System-Level Coupling and Interactions
8	10/18	Proposal Development for System and Subsystem Model Development: System Decomposition, Interface Control Documentation
9	10/25	Space System Design Optimization and Exploration Techniques / 1 <sup>st</sup> Interim Project Report Due / 1 <sup>st</sup> Progress Presentations
10	11/1	Design Sensitivity Analysis, Trade-Off Studies and Approximations and Multi-Objective System Level Optimization, Spacecraft Design and Sizing
11	11/8	Launch Vehicles and Spacecraft Architectures and Subsystem Presentations <ul style="list-style-type: none"> <li>• Communications, Command and Data Handling</li> <li>• Power</li> </ul>
12	11/15	Launch Vehicles and Spacecraft Architectures and Subsystem Presentations <ul style="list-style-type: none"> <li>• Thermal / 2<sup>nd</sup> Interim Project Report Due / 2<sup>nd</sup> Progress Presentations</li> </ul>
13	11/22	Launch Vehicles and Spacecraft Architectures and Subsystem Presentations <ul style="list-style-type: none"> <li>• Propulsion / 2<sup>nd</sup> Progress Presentations</li> </ul>
14	11/29	Launch Vehicles and Spacecraft Architectures and Subsystem Presentations <ul style="list-style-type: none"> <li>• Attitude Dynamics and Control</li> <li>• Structures</li> </ul>
15	12/6	Launch Vehicles and Spacecraft Architectures and Subsystem Presentations <ul style="list-style-type: none"> <li>• Guidance, Navigation, and Control</li> <li>• Mission Operations, Spacecraft Integration</li> </ul>
16	12/13	Miscellaneous Topics, Summary, Review / Final project presentations