THE DEPARTMENT OF AERONAUTICS AND ASTRONAUTICS

AA 420 SPACECRAFT AND SPACE SYSTEMS DESIGN I

WINTER QUARTER

CREDITS AND CONTACT HOURS: 4 credits, Five 110-minute lectures per week.

COORDINATOR: Adam P. Bruckner, Professor of Aeronautics and Astronautics

TEXTBOOK: Space Mission Engineering: The New SMAD, J. R. Wertz, D.F. Everett, and J.J. Puschell, eds., Microcosm Press, Torrance, CA, 2011.

SUPPLEMENTAL REFERENCES: Space Vehicle Design, 2nd ed., M. D. Griffin and J. R. French, AIAA Education Series, American Institute of Aeronautics and Astronautics, Washington, DC, 2004. NASA reports, AIAA/ASME/IEEE conference and journal papers, etc.

CATALOG DATA: SPACECRAFT AND SPACE SYSTEMS DESIGN I, Required
Design of space systems and spacecraft for advanced near-Earth and interplanetary missions. Elements of astrodynamics, the space environment, planetary environments, and space systems engineering. Mission design and analysis, space vehicle propulsion and flight mechanics, atmospheric entry and aerobraking, configuration and structural design, nuclear and solar power systems, thermal management, systems integration, advanced concepts, and other aspects of space engineering needed for general capability in space systems. Offered: W. Prerequisite: AA 310 or permission of instructor; recommended: AA 419.

PREREQUISITES BY TOPIC:

1) Aerodynamics
2) Orbital and atmospheric flight mechanics.
3) Dynamics of flight vehicles.
4) Structural analysis.
5) Heat transfer.

OUTCOMES:

1) Students will understand the function of spacecraft subsystems and how they might be designed.
2) Students will understand the state of the art in spacecraft system and subsystem design and the trade-offs between them.
3) Students will experience choosing and narrowing high-level mission goals and requirements into specific tasks for design.
4) Students will experience self-organization, delegation, teamwork, communication to peers and visitors, fiscal and schedule maintenance.
5) Students will experience hands-on prototyping and testing of their chosen design.

RELATIONSHIP TO STUDENT OUTCOMES:

a) An ability to apply knowledge of mathematics, science, and engineering
b) An ability to design and conduct experiments, as well as to analyze and interpret data.
c) An ability to design a system, component, or process to meet desired needs.

d) An ability to function on multi-disciplinary teams.
e) An ability to identify, formulate, and solve engineering problems.
f) An understanding of professional and ethical responsibility.
g) An ability to communicate effectively.
h) The broad education necessary to understand the impact of engineering solutions in a global and societal context.
i) A recognition of the need for, and an ability to engage in life-long learning.
j) A knowledge of contemporary issues.
k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

TOPICS:

1)	Introduction to space systems engineering.	(2 lectures)
2)	Definition of design problem and creation of design teams.	(4 lectures)
3)	Discussion of ethics in design	
4)	The space environment.	(3 lectures)
5)	Launch vehicles: Earth-to-orbit launch trajectories.	(5 lectures)
6)	Atmospheric entry and aerobraking	(3 lectures)
7)	Elements of spacecraft configuration and design.	(7 lectures)
8)	Solar and nuclear power systems; thermal management.	(4 lectures)
9)	System integration.	(2 lectures)