AEROSPACE DESIGN 1
EAS4700-1029 Section 0075
Class Periods: MON Periods 9-10 (4:05 – 6:00 pm)
WED Period 9 (4:05 – 4:55 pm)
Location: CSE E 119
Academic Term: Fall 2022

Instructor:
Mr. Michael Generale
mgenerale@ufl.edu
Campus Phone Number: 352-294-1183
Mondays and Wednesdays 1:00 – 3:00 PM, NEB 125

Learning Assistants:
Please contact through the Canvas website
- Nate Esteban: nateesteban@ufl.edu Office Hours and location TBD
- Raian Sadman: raiansadman@ufl.edu Office Hours and location TBD
- Kayla Woods: kayla.woods@ufl.edu Office Hours and location TBD

Course Description
Applications of the principles of analysis and design to aerospace vehicles. Emphasizes astronautics.
3 credits.

Course Pre-Requisites / Co-Requisites
EAS4510 Astrodynamics and EML4312 Control of Mechanical Engineering Systems with at least a D grade.
PER THE MAE DEPARTMENT, THIS WILL BE STRICTLY ENFORCED, NO MATTER IF YOU HAVE BEEN ABLE TO REGISTER FOR THE CLASS.

Working knowledge of MATLAB, Simulink, STK, and a CAD program such as Solidworks, is required. Students will have to learn tools as they go.

Course Objectives
By the end of this course, you should be able to do the following:
1. Prepare technical documents in the aerospace industry.
2. Give technical presentations, and develop communication skills.
3. Work in a team and lead a team.
4. Seek, find, and assimilate the knowledge you need to solve new problems.

Materials and Supply Fees
N/A

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	High
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and	High - Assessed

welfare, as well as global, cultural, social, environmental, and economic factors	
3. An ability to communicate effectively with a range of audiences	High
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	High - Assessed
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	High - Assessed
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	High
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Low

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Aerospace Engineering UF Student Learning Outcomes:

Outcome	Coverage*
1. Apply knowledge of mathematics, science, and engineering principles to aerospace engineering problems (ABET Outcome (1))	High
2. Design and conduct aerospace engineering experiments and analyze and interpret the data (ABET Outcome (6))	High
3. Design an aerospace engineering system, component or process to meet desired needs within realistic economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability constraints (ABET Outcome (2))	High - Assessed
4. Communicate technical data and design information effectively in speech and in writing to other aerospace engineers (ABET Outcome (3))	High

Required Textbooks and Software

- **Elements of Spacecraft Design by Charles D. Brown**
  ISBN (print): 978-1-56347-524-5
  eISBN: 978-1-60086-179-6
  Publication Date: January 1, 2002

- **CubeSat 101 NASA reference guide for designing, building, and planning a CubeSat mission**
  https://www.nasa.gov/sites/default/files/atoms/files/nasa_csli_cubesat_101_508.pdf

- **System Engineering Handbook NASA reference guide for Systems Engineering.**
  https://www.nasa.gov/seh/index.html

You must have access to the following software:

- MATLAB and a CAD program.
- Microsoft Project (available for download from UF)
- Satellite Tool Kit (STK) installed on individual machines, with running license.

Microsoft Project is a project management tool for generating schedules, tracking resources, and project status.

STK is a tool for simulating orbital mechanics on your computer. It is an industry standard for simulating spaceflight and vehicle performance.

STK LICENSE INSTRUCTIONS:

1. Go to the "STK UPLOAD FILES" folder in the class CANVAS site.
2. Open the "AGISTKInstallation.pdf" file and follow the instructions.
3. If you have any issues loading or running STK, first try the UF IT Help Desk. If that doesn't answer your issue, contact either Professor Generale or a Learning Assistant.

Recommended Materials

- **Human Spaceflight Mission Analysis and Design 2nd edition by Larson, McQuade & Pranke**
  Publication Date 2014

  NOTE: Even though I made it optional for this course, I cannot recommend Human Spaceflight Mission Analysis and Design strongly enough. It is a relatively expensive text. However, the wealth of knowledge it contains will serve you well in your design career, whether you enter into human or robotic spaceflight.

Course Schedule

Week / Dates	Topic	Notes
1 24 AUG 22	**Module 1** • Course, project, and instructor introduction. • Project Overview • Group assignments • Introduction to Project Management principles • What is a CubeSat?	Reading reference: **Elements of Spacecraft Design (ESD**) Ch. 2 Systems Engineering **CubeSats 101** **Systems Engineering Handbook (SEH)** 3.0 NASA Program/Project Life Cycle **Human Spaceflight Mission Analysis and Design (HSMAD)** * Ch. 1 An Introduction to Human Spaceflight Ch.2 Designing Human Space Missions *Optional Text
2 29/31 AUG 22	**Module 2** • Assessing risk: Problem Analysis-Decision Analysis	Reading reference: **SEH** 4.0 System Design Process **SEH** 6.2 Requirements Management **SEH** 6.4 Risk Management **SEH** 6.8 Decision Analysis

	• Requirements development • Operations Concept / CONOPS development • The importance of scheduling and tracking open work • Imaging System Selection Considerations	**Work to complete for 9/7:** • Draft requirements list • Identify Trade Studies • Provide Initial spacecraft concept drawings
3 07 SEP 22	**Bi-weekly Project Review #1**	Reading reference: **ESD** Ch. 3 Orbital Mechanics **ESD** Ch. 5 Attitude Control **ESD** Ch. 4 Propulsion **ESD** Ch. 6 Power Systems **HSMAD*** Ch. 24 Propulsion Systems
4 12 / 14 SEP 22	**Module 3** • Lunar Orbits • Attitude Control • Designing the Propulsion System and Selecting Elements • Electrical Power-Schematic - Wiring Diagram -Cable Routing Diagram • Power management system design	Reading Reference: **ESD** Ch. 7 Thermal Control **ESD** Ch. 10 Structures Work to complete for 9/21: • Draft ADCS concept • Draft Propulsion system design • Draft Power Budget • Draft Thermal Control Plan • Spacecraft design updates
5 19 / 21 SEP 22	**Module 4** • Thermal Control Methods • Structural design considerations • Effective Presentations	

	Bi-weekly Project Review #2	
6 26 / 28 SEP 22	**<u>Module 5</u>** • Communications and data systems • Designing an Effective Test Plan	Work to complete for 03 OCT: Draft PDR presentation
7 03 / 05 OCT 22	**<u>Module 6</u>** **Pre-PDR Project Review**	ALL PDR PRESENTATIONS MUST BE UPLOADED TO CANVAS NO LATER THAN: **3 PM 07 OCT 2022** **<u>- NO EXCEPTIONS -</u>**
8 10 / 12 OCT 22	**MON 10 OCT: Groups 1,2,3 PDR Presentations** **WED 12 OCT: Groups 4,5 PDR Presentations**	Each team will be given the 30 MINUTES to make their presentations. Presentation time will be limited to allow all groups to present within the limitations of the scheduled class periods.
9 17 / 19 OCT 22	**MON 17 OCT: Groups 6,7,8 PDR Presentations** **WED 19 OCT Bi-weekly Project Review #3**	ALL MID-TERM PEER REVIEWS MUST BE UPLOADED TO CANVAS NO LATER THAN: **3 PM 21 OCT 2022** **<u>- NO EXCEPTIONS -</u>**
10 24 / 26 OCT 22	PDR Debriefs	Reviewing the scoring of PDR presentations focusing on areas for improvement.
11 31OCT / 02 NOV 22	**Bi-weekly Project Review #4**	Work to complete for 07 NOV: Draft CDR presentation
12 07 / 09 NOV 22	**PRE-CDR Project Review**	
13 14 / 16 NOV 22	**PRE-CDR Project Review**	ALL CDR PRESENTATIONS MUST BE UPLOADED TO CANVAS NO LATER THAN: **3 PM 18 NOV 2022** **<u>- NO EXCEPTIONS -</u>**
14 21 NOV 22	• **<u>Final Report Review</u>**	A review of each team's rough draft of the Final Design Report.
23 NOV 22	**THANKSGIVING BREAK**	

15 28 / 30 NOV 22	**MON 28 NOV Groups 8,7,6 CDR Presentations** **WED 30 NOV Groups 5,4 CDR Presentations**	Each team will be given 30 MINUTES to make their presentations. Presentation time will be limited to allow all groups to present within the limitations of the scheduled class periods.
16 05/07 DEC 22	**MON 05 DEC Groups 3,2,1 CDR Presentations** **WED 07 DEC Final Report Review**	Each team will be given 30 MINUTES to make their presentations. Presentation time will be limited to allow all groups to present within the limitations of the scheduled class periods. A review of each team's interim draft of the Final Design Report.
FINALS WEEK 12 DEC 22	**FINAL REPORTS DUE**	ALL FINAL REPORTS MUST BE UPLOADED TO CANVAS NO LATER THAN: **3 PM 14 DEC 2022** **- NO EXCEPTIONS -**

Attendance Policy, Class Expectations, and Make-Up Policy

Students are expected to attend all meetings. This course is highly participative and group work-intensive. There will be no early/late presentations. Please make your travel arrangements according to the presentation dates specified in the syllabus. The general rule is no make-up presentations and no rescheduling of presentations to other times.

Attendance in class will be recorded. Students who provide a minimum of 24 hours of notice with an adequate reason for missing a class will be granted an excused absence. Notice may be provided to the instructor in the form of an email.

Any student who "ghosts" or cuts off all communication with this course (stops attending lectures, stops working with their group, and does not complete assigned work) will be provided a grade only for work they have completed. A grade of 0 (zero) will be given for all missing work. Example: If 30% of the work has been completed, the maximum possible grade will be 30%.

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx. The students remain entirely responsible for timely communications with the instructor.

Evaluation of Grades

This course introduces all elements of the spacecraft design process. Students are organized into design teams and associated with different subsystems and tasks to develop a solution to a space vehicle system's problem of practical interest by drawing on their background in aerospace engineering science, machine design, and manufacturing methods.

Skills exercised include:

- Problem definition and requirement analysis
- Design specifications
- Concept development
- Reliability
- Evaluation of alternative solutions
- Materials considerations
- Engineering prototyping
- Mission analysis
- Costs and schedule analysis
- Presentation skills

This course is communication-intensive and writing-intensive. You are expected to meet with your groups and work on your project extensively outside class periods.

Grading will be determined as follows

Assignment	Time Frame	Type	Points	%
Bi-Weekly Project Review (BPR)	Bi-weekly	Group	40	10
Preliminary Design Review (PDR)	Mid October	Group	1000	20
Critical Design Review (CDR)	Late November	Group	1000	20
Final Design Report (FDR)	Finals	Group	1000	20
Design Showcase presentations	Late November	Group	10	05
Peer Evaluation	Mid-Term/Finals	Individual	40	05
Individual PDR Grade	Mid-Term	Individual	Varies	10
Individual CDR Grade	Finals	Individual	Varies	10
			TOTAL	100

Bi-Weekly Project Review (BPR) Group Grade: BPRs will be held every other week. The instructor and Grading Assistants will meet with each group individually to get the status of your project work. This review serves two purposes: 1.) it allows the students to ask questions and get clarifications from the instructor/ Grading Assistants. 2.) It allows the instructor and Grading Assistants to offer suggestions for your consideration and better understand the quality of the work you are performing both individually and as a group. The Pre-PDR and Pre-CDR reviews serve the same purpose as a BPR, but with a focus on the presentations you are preparing. **BPRs are worth a total of 10% of your grade** and serve as quizzes. You will be expected to show examples of and explain your work.

Preliminary Design Review (PDR) Group Grade: PDR for all teams will be held on the week of **10 OCT 2022**. Each group will present their work to the instructor and customer. **PDR is worth 20% of your group grade** and serves as your midterm exam.

Critical Design Review (CDR) Group Grade: CDR will be held on the week of **14 NOV 2022**. Each group will present their work to the instructor and customer. **CDR is worth 20% of your group grade** and serves as your final exam.

Design Showcase Grade: You will be participating in the Mechanical Engineering Design Showcase at the end of the semester (specific dates to be announced). Your group performance in the Poster session and 90-second video is **worth 5% of your group grade**. This grade is based on judging your group project as defined by the rubric for the Design Showcase. Additionally, you will have the opportunity to share your résumé with engineering companies participating in the judging of the Design Showcase, such as Northrup-Grumman. Design showcase is an opportunity for you to demonstrate your skills and get face time with potential employers.

You will also have the opportunity to submit your résumé to the guest evaluators This is optional, and no points are awarded. It is simply an opportunity for you to market yourself.

Final Design Report (FDR) Group Grade: The final report on your group design is due NO LATER THAN **14 DEC 2022**. The FDR goes into greater detail than is possible in the limited time of the PDR and CDR and is your opportunity to address shortcomings identified in your CDR presentation. **The final report is worth 30% of your group grade**. A suitable report format may be found on the class CANVAS website.

Peer evaluation grade: A peer evaluation of each member of your group is due at mid-term **21 OCT 2022**, and a final **07 DEC 2022** and in total is **worth 10% of your total grade**. This is a semester-long update-able grade (everyone is given a chance to improve their performance till the end). A standardized evaluation will be used for this evaluation. This is important because your team must function well together for your team to be successful. Periodic feedback on all team members' performance is the only way to keep the group functioning well.

Individual Work Grade: Your individual performance in the PDR and CDR are each **worth 10% of your grade**. This grade is based on your individual performance in your primary area of responsibility for the group project as defined by the rubric for the project.

GatorEval Survey Bonus: A voluntary course and instructor evaluation in GatorEvals is requested and is valued as a 5% bonus if a minimum of 60% of the class participates. Students are expected to provide honest, professional, and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Students will be notified when the evaluation period opens and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/.

Guidance on how to give feedback professionally and respectfully is available at https://gatorevals.aa.ufl.edu/students/ . Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/ .

The course CANVAS website provides the rubric for evaluation of the mid-term and final presentations and the final report.

Grading Policy

Percent	Grade	Grade Points
94 to 100	A	4.00
90 to 93.99	A-	3.67
85 to 89.99	B+	3.33
80 to 84.99	B	3.00
75 to 79.99	B-	2.67
70 to 74.99	C+	2.33
65 to 69.99	C	2.00
60 to 64.99	C-	1.67
55 to 59.99	D+	1.33
50 to 54.99	D	1.00
45 to 49.99	D-	0.67
Less Than 45	E	0.00

More information on UF grading policy may be found at:
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Students Requiring Accommodations
Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting https://disability.ufl.edu/students/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation
Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

In-Class Recording
Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services.

A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://sccr.dso.ufl.edu/process/student-conduct-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Jennifer Nappo, Director of Human Resources, 352-392-0904, jpennacc@ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: https://registrar.ufl.edu/ferpa.html

Campus Resources:

Health and Wellness

U Matter, We Care:
Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: https://counseling.ufl.edu, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence
If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

Academic Resources

E-learning technical suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Connections Center, Reitz Union, 392-1601. Career assistance and counseling; https://career.ufl.edu.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall*,* 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus*:* https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/;https://care.dso.ufl.edu.

On-Line Students Complaints*: https://distance.ufl.edu/state-authorization-status/#student-complaint*.