AEROSPACE DESIGN 1
EAS4700 Section 2093
Class Periods: TUE Periods 9-10 (4:05 – 6:00 PM)
THU Period 9 (4:05 – 4:55 PM)
Location: PUGH 120
Academic Term: Fall 2023

Instructor:
Mr. Michael Generale
mgenerale@ufl.edu
Campus Phone Number: 352-294-1183
Office Hours: Tuesdays and Thursdays, 1:00 – 3:00 PM, NEB 125. Appointments are *strongly* encouraged.

Learning Assistant:

- Learning Assistant, office hours, and location TBD at this time

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

Course Pre-Requisites / Co-Requisites
EAS4510 Astrodynamics and **EML4312 Control of Mechanical Engineering Systems** with at least a D grade.

A working knowledge of MATLAB, Simulink, ANSYS, 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 welfare, as well as global, cultural, social, environmental, and economic factors	High - Assessed
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
  -Available for free download from Marston Library-

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

You must have access to the following software:

- MATLAB, ANSYS, and a CAD program.
- Microsoft Project (available from UF). Microsoft Project is a project management tool for generating schedules, tracking resources, and project status.
- Satellite Tool Kit (STK) installed on individual machines, with running license. STK is a tool for simulating orbital mechanics on your computer. It is an industry-standard for simulating spaceflight and vehicle performance.

SOFTWARE UPLOADING INSTRUCTIONS:

- 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, try the UF IT Help Desk first. If that doesn't answer your issue, contact Professor Generale or a Learning Assistant.

Recommended Materials

The following texts are ***not*** required for this course. However, these are excellent references for your professional career. I believe their expense makes them cost-prohibitive for students. While I will use them in lesson preparation, you ***will not*** be disadvantaged if you do not purchase them.

- **Space Mission Analysis and Design 3rd edition by Larson & Wertz (SMAD)**
  Publication Date 1999

A note on this suggested text: Space Mission Analysis and Design should be available through the bookstore OR directly from the publisher in physical and electronic formats. This text is a good reference book that will be useful in a career as a design engineer.

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

A note on this suggested text: Human Spaceflight Mission Analysis and Design is available from the publisher in physical and electronic formats. This text has much the same data as SMAD but with a focus on HUMAN-rated spacecraft. If you choose to purchase the eBook version, you will get a 10% discount from the publisher (approximately $10 savings). You may use this link: https://www.spacetechnologyseries.com/~spacet9/books/Human-Spaceflight.html. This is a very useful book that NASA uses in professional development courses.

Course Schedule (subject to change)

The following is the anticipated schedule for lectures and reading assignments. As with any schedule, it is subject to change due to unforeseeable issues. Reading assignments are to familiarize you with the material covered in class.

WEEK	DAY	DATE	TOPICS	NOTES
1	TH	24-Aug	**Module 1** • Course, and instructor introduction. • Project Overview • Introduction to Project Management Principles • Operations Concept / CONOPS and Risk Management • Examples of a Good CONOPS • Starting Your Design • Group assignments	**Reading assignment:** Project Requirements Document Elements of Spacecraft Design (ESD) Ch. 2, 2.1, 2.1.1, 2.1.2 Systems Engineering Ch. 3.6 Orbital Mechanics: Lunar Trajectories Systems Engineering Handbook (SEH) Ch 2 Fundamentals of Systems Engineering Ch. 3 NASA Program/Project Life Cycle
2	TU	29-Aug	**Module 2** • Kepner-Trego PA/DA • Requirements Definition • Schedules and OISRs • Designing the Propulsion System and Selecting Elements • Guidance, Navigation, Attitude Control • Astrodynamics Review	**Reading assignment:** SEH 4.0 System Design Process 6.4 Risk Management 6.8 Decision Analysis 6.2 Requirements Management Work to complete for Bi-weekly Project Report #1 due 31 AUG in class: • Draft requirements list • Draft CONOPS • Provide Initial spacecraft concept drawings • Team member roles

2	TH	31-Aug	**Bi-weekly Project Report #1**	**Reading assignment:** ESD Ch. 4 Propulsion Ch. 5 Attitude Control
3	TU	5-Sep* Virtual Class	GUEST LECTURER – NASA Project Manager John Carson: SPLICE	**Reading assignment:** ESD Ch. 7 Thermal Control Ch. 10 Structures
3	TH	7-Sep* Virtual Class	**Module 3** • Structural design considerations • Thermal Control Methods	**Reading assignment:** ESD Ch. 6 Power Systems Ch. 9.4 Communication System Design
4	TU	12-Sep	**Module 4** • Electrical Power-Schematic - Wiring Diagram -Cable Routing Diagram • Power management system design • Communications and data systems	***Work to complete for 14 SEP***: • Draft ADCS concept • Draft Propulsion system design • Draft Power Budget • Draft Thermal Control Plan Spacecraft design updates
4	TH	14-Sep	**Module 5** **Bi-weekly Project Review #2**	
5	TU	19-Sep	**Module 6** • Effective Presentations • Designing an Effective Test Plan • Budgeting and scheduling for your project • Leadership Vs. Management	
5	TH	21-Sep	Guest Lecturer - Leonard Duncil: Launch Site Processing	***Work to complete for 28 SEP:*** • Draft SDR presentation

6	TU	26-Sep	**Pre-SDR Project Review**	ALL SDR PRESENTATIONS AND PEER REVIEWS MUST BE UPLOADED TO CANVAS NO LATER THAN: **3 PM FRI 29 SEP 2023** **- NO EXCEPTIONS -**
6	TH	28-Sep		
7	TU	3-Oct	**SDR Presentations**	
7	TH	5-Oct	SDR feedback	
8	TU	10-Oct	Project/design reviews & group work time	
8	TH	12-Oct	Project/design reviews & group work time	
9	TU	17-Oct	Project/design reviews & group work time	
9	TH	19-Oct	Project/design reviews & group work time	
10	TU	24-Oct	Project/design reviews & group work time	
10	TH	26-Oct	Project/design reviews & group work time	
11	TU	31-Oct	Project/design reviews & group work time	
11	TH	2-Nov	Project/design reviews & group work time	
12	TU	7-Nov	Project/design reviews & group work time	
12	TH	9-Nov	Project/design reviews & group work time	
13	TU	14-Nov	Project/design reviews & group work time	
13	TH	16-Nov	Project/design reviews & group work time	ALL PDR PRESENTATIONS MUST BE UPLOADED TO CANVAS NO LATER THAN: **11 PM TUE 21 NOV 2023** **- NO EXCEPTIONS -**
14	TU	21-Nov	Project report reviews & group work time	
14	TH	23-Nov	**-THANKSGIVING HOLIDAY -** **NO CLASS**	
15	TU	28-Nov	**PDR Presentations**	
15	TH	30-Nov	PDR Feedback for report generation	ALL FINAL REPORTS AND FINAL PEER REVIEWS MUST BE UPLOADED TO CANVAS NO LATER THAN: **11 PM TUE 5 DEC 2023** **- NO EXCEPTIONS -**
16	TU	5-Dec	Final Report reviews	

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 or rescheduling of presentations to other times.

Attendance in class will be recorded. Students who provide **at least 24 hours of notice** with an adequate reason for missing a class will be granted an excused absence. You may provide notice to the instructor in the form of an e-mail.

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 get a grade **only** for their **completed work**. A 0 (zero) grade will be given for all missing work. Example: If 30% of the work is 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 communication 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. There is NO CURVE.

Skills exercised include:

- Problem definition and requirement analysis
- Design specifications
- Concept development
- Reliability
- Evaluation of alternative solutions
- Materials considerations
- 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	Percentage
Group Systems Definition Review (SDR) Grade	Midterm	Group	15
Individual SDR Grade	Midterm	Individual	15
Group Preliminary Design Review (PDR) Grade	Finals	Group	15
Individual PDR Grade	Finals	Individual	15
Design Report (DR) Grade	Finals	Group	10
Individual Design Report (DR) Grade	Finals	Individual	10
Bi-weekly Project Report (BPR) Grade	Bi-weekly	Group	05
Design Show Case Products Grade	Finals	Group	05
Midterm Peer Evaluation Grade	Midterm	Individual	05
Final Peer Evaluation Grade	Finals	Individual	05
		TOTAL	100

Bi-Weekly Project Report (BPR) Group Grade: BPRs will be due roughly every two weeks. The Integration Engineer will provide a written status of your project work. This review will summarize the work done on the project to date. The purpose of the BPR is to allow the instructor and Grading Assistants to offer suggestions for your consideration and better understand the quality of the work you are performing individually and as a group. You are expected to show examples of and explain the work done to date and provide a summary of planned work and due dates.

The SDR, PDR, and DR reviews are live in-person reviews that serve the same purpose as a BPR but with a focus on the presentations you are preparing. This will allow you to get feedback on your proposed presentations.

Systems Definition Review (SDR) Group Grade: Pre-SDR for all teams is scheduled for the week of **01 OCT 2023***. Each group will present their work to the instructor and customer. **SDR is worth 15% of your group and 15% of your individual grade** and serves as your midterm exam.

Preliminary Design Review (PDR) Group Grade: PDR is scheduled for the week of **26 NOV 2023***. Each group will present their work to the instructor and customer. **PDR is worth 15% of your group and 15% of your individual grade** and serves as your final exam.
*These dates are subject to minor changes as outlined in Design Showcase.

Design Showcase: You will participate in the Mechanical Engineering Design Showcase at the end of the semester. Design Showcase allows you to demonstrate your skills and get face time with potential employers. The critiques offered by the guest judges will NOT impact your grade. They are to give you an insight into how your work will be critiqued in your future jobs. **Design Showcase products are worth 5% of your group grade.**

- You will produce a 90-second promotional video and an abstract outlining how your design meets the project requirements.
- Your SDR Presentation will be your Design Showcase Presentation. Design Showcase dates may vary slightly from the dates published for SDR, and the date of the SDR will flex accordingly.
- Engineering companies such as Northrup-Grumman, Cummins, and others will be participating in judging the Design Showcase.
- You will also be able 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.

Design Report (DR) Group Grade: The final report on your group design is due NO LATER THAN **05 DEC 2023 AT 11:00 PM**. The DR goes into greater detail than is possible in the limited time of the Pre-SDR and SDR and is your opportunity to address shortcomings identified in your SDR presentation. **The design report is worth 10% of your group and individual 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 **29 SEP 2023** and a final **05 DEC 2023** and, **in total is worth 10% of your total grade (5% each)**. A standardized form is 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. This also gives the instructor insight into your performance in this class. The grade awarded will be the average of the input from your peers.

NOTE: It is statistically improbable that *every* group member in any given group will score perfectly in the peer evaluation. Any group providing perfect scores to *every* team member indicates collusion to inflate your grades. Each group member will get ZERO (0) points for the peer eval if collusion is suspected. That doesn't mean any INDIVIDUAL cannot get a perfect score, but it is improbable that any randomly assigned group will have ***all*** high performers. Be *fair*, *honest*, *realistic*, and *impartial* in your evaluations. This is not a popularity poll nor an opportunity to gift a friend. It also is not an opportunity to bash someone you do not get along with.

GatorEval Survey Bonus: A voluntary GatorEvals input is requested for a 3% bonus if a minimum of 60% of the class participates. See the "*Course Evaluation*" below for details.

Attendance Bonus: A bonus of 3% will be applied to individual grades for attendance of 90% or greater.

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

Grading Policy

Percent	Grade	Grade Points
95 to 100	A	4.00
90 to 94.99	A-	3.67
85 to 89.99	B+	3.33
82.5 to 84.99	B	3.00
80 to 82.49	B-	2.67
75 to 79.99	C+	2.33
72.5 to 74.99	C	2.00
70 to 72.49	C-	1.67
65 to 69.99	D+	1.33
62.5 to 64.99	D	1.00
60 to 62.49	D-	0.67
Less Than 60	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 varied perspectives and lived experiences within our community and is committed to supporting the University's core values, including the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of race, creed, color, religion, age, disability, sex, sexual orientation, gender identity and expression, marital status, national origin, political opinions or affiliations, genetic information, and veteran status.

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
- HWCOE Human Resources, 352-392-0904, student-support-hr@eng.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/getting-help/; *https://distance.ufl.edu/state-authorization-status/#student-complaint*.