AEROSPACE DESIGN 1

EAS4700 Section 1029

Class Periods: MON Periods 9-10 (4:05 – 6:00 pm)
WED Period 9 (4:05 – 4:55 pm)

Location: WEI 1094

Academic Term: Spring 2023

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

Learning Assistants:
Please contact them through the Canvas website

- Kailey Carpenter: kaileycarpenter@ufl.edu Office Hours and location TBD
- Nate Esteban: nateesteban@ufl.edu Office Hours and location TBD
- Raian Sadman: raiansadman@ufl.edu Office Hours and location TBD

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

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

A note on this required text: Human Spaceflight Mission Analysis and Design is available through the bookstore OR directly from the publisher in both physical and electronic formats. If you choose to purchase the ebook version, you will get a 10% discount from the publisher (an approx. $10 savings). You may use this link: https://www.spacetechnologyseries.com/~spacet9/books/Human-Spaceflight.html

- **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, ANSYS, and a CAD program.
- Microsoft Project (available for download 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, first try the UF IT Help Desk. If that doesn't answer your issue, contact either Professor Generale or a Learning Assistant.

Course Schedule (subject to change)

Week / Dates	Topic	Notes
1 09/11 JAN	**<u>Module 1</u>** • Course, ULA, and instructor introduction. • Group assignments • Project Overview • Operations Concept / CONOPS development • Design considerations for your project • Introduction to Project Management principles _____ • Scheduling and tracking open work • Extravehicular Activities	Reading assignment: **Project Requirements Document** **Elements of Spacecraft Design (ESD**) Ch. 2, 2.1, 2.1.1, 2.1.2 Systems Engineering **Systems Engineering Handbook (SEH)** Ch 2 Fundamentals of Systems Engineering Ch. 3 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 Ch 22 Extravehicular Activity (EVA) Systems Introduction
16 JAN	MLK Holiday	
2 18 JAN	**<u>Module 2</u>** • **<u>Guest Lecturer</u>**: NASA astronaut Nicole Stott on EVA and spacecraft human factors	Reading assignment: **SEH** 4.0 System Design Process 6.4 Risk Management 6.8 Decision Analysis 6.2 Requirements Management **ESD** Ch. 10 Structures ***<u>Work to complete for 25 JAN:</u>*** • <u>Draft requirements list</u> • <u>Draft CONOPS</u> • <u>Provide Initial spacecraft concept drawings</u> • <u>Team member roles</u>

3 23 /25 JAN	**Module 3** • Assessing risk: Problem Analysis-Decision Analysis • Structural design considerations • Requirements development • Attitude Control • Designing the Propulsion System and Selecting Elements **Bi-weekly Project Report #1 Due 25 JAN in class**	Reading assignment: **ESD** Ch. 5 Attitude Control Ch. 4 Propulsion Ch. 6 Power Systems **HSMAD** Ch. 19. Guidance, Navigation, and Control Ch. 20 Designing Power Systems Ch. 24 Propulsion Systems
4 30 JAN / 01 FEB	**Module 4** • Electrical Power-Schematic - Wiring Diagram -Cable Routing Diagram • Power management system design • Communications and data systems • **Guest Lecturer:** NASA Senior Discipline Engineer, Mr. Leonard Duncil, KSC Launch Services Program	Reading assignment: **ESD** Ch. 7 Thermal Control **HSMAD** Ch. 16 Thermal Control ***Work to complete for 06 FEB***: • Draft ADCS concept • Draft Propulsion system design • Draft Power Budget • Draft Thermal Control Plan • Spacecraft design updates
5 06 /08 FEB	**Module 5** **Bi-weekly Project Review #2** • Thermal Control Methods • Effective Presentations	Reading assignment: **HSMAD** Ch. 29 Estimating the Cost of Crewed Space Systems
6 13 / 15 FEB	**Module 6** • Designing an Effective Test Plan • Budgeting for your project • Leadership Vs. Management	***Work to complete for 20 FEB:*** Draft SDR presentation

7 20 / 22 FEB	**<u>Module 7</u>** **Pre-SDR Project Review**	ALL SDR PRESENTATIONS MUST BE UPLOADED TO CANVAS NO LATER THAN: **3 PM 24 FEB 2023** **<u>- NO EXCEPTIONS -</u>**
8 27 FEB / 01 MAR	**MON 27 FEB: Groups 1,2 Pre-SDR Presentations** **WED 01 MAR: Groups 3,4 Pre-SDR Presentations**	Each team will be given 45 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 06 / 09 MAR	**MON 06 MAR: Groups 5,6 Pre-SDR Presentations** **WED 09 MAR Bi-weekly Project Review #3**	ALL MID-TERM PEER REVIEWS MUST BE UPLOADED TO CANVAS NO LATER THAN: **3 PM 04 MAR 2023** **<u>- NO EXCEPTIONS -</u>**
13 / 15 MAR	SPRING BREAK	
10 20 / 22 MAR	Pre-SDR Debriefs	Reviewing the scoring of PDR presentations focusing on areas for improvement. **<u>Work to complete for :27 MAR</u>** Draft SDR presentation
11 27 / 29 MAR	**PRE-SDR Project Review**	ALL SDR PRESENTATIONS MUST BE UPLOADED TO CANVAS NO LATER THAN: **3 PM 30 MAR 2023** **<u>- NO EXCEPTIONS –</u>**
12 03 / 05 APR	**MON 03 APR Groups 6,5 SDR Presentations** **WED 05 APR Groups 4,3 SDR Presentations**	Each team will be given 45 MINUTES to make their presentations. Presentation time will be limited to allow all groups to present within the limitations of the scheduled class periods

13 10 / 12 APR	**MON 10 APR Groups 2,1 SDR Presentations**	Each team will be given 45 MINUTES to make their presentations. Presentation time will be limited to allow all groups to present within the limitations of the scheduled class periods.
14 17 / 19 APR	**Final Report Reviews**	A review of each team's interim draft of the Final Design Report.
15 24 / 26 APR	**MON 24 APR Final Report Review** **WED 26 APR FINAL REPORTS DUE** **WED 26 APR FINAL PEER REVIEWS DUE**	ALL **FINAL REPORTS** MUST BE UPLOADED TO CANVAS NO LATER THAN: **6 PM 26 APR 2023** **- NO EXCEPTIONS –** ALL **FINAL PEER REVIEWS** MUST BE UPLOADED TO CANVAS NO LATER THAN: **6 PM 26 APR 2023** **- NO EXCEPTIONS -**
01 / 03 MAY	FINALS WEEK	

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 their completed work. 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 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 Pre-Systems Definition Review (Pre-SDR) Grade	Midterm	Group	15
Individual Pre-SDR Grade	Midterm	Individual	15
Group Systems Definition Review (SDR) Grade	Finals	Group	15
Individual SDR 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 that has been 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 will be expected to show examples of and explain the work done to date and provide a summary of planned work and due dates.

The Pre-SDR, SDR, 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 afford you the opportunity to get feedback on your proposed presentations.

Pre-Systems Definition Review (Pre-SDR) Group Grade: Pre-SDR for all teams will be held from **27 FEB to 06 MAR 2023**. Each group will present their work to the instructor and customer. **Pre-SDR is worth 15% of your group and individual grade** and serves as your midterm exam.

System Definition Review (SDR) Group Grade: SDR will be held on the week of **03 -10 APR 2023*.** Each group will present their work to the instructor and customer. **SDR is worth 15% of your group and 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 is an opportunity for 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 provided 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 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.

Design Report (DR) Group Grade: The final report on your group design is due NO LATER THAN **26 APR 2023**. 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 **04 MAR 2023**, and a final **26 APR 2023** and **in total is worth 10% of your total grade (5% each)**. A standardized form 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. 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 will score perfectly in the Peer evaluation. Any group providing perfect scores to each team member indicates collusion to inflate your grades. Each group member will get ZERO (0) points for the peer eval if collusion is indicated.

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
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*.