San José State University

College of Engineering, Aerospace Engineering
AE 273 – Aircraft Subsystems – Spring 2022

The course syllabus is posted on CANVAS as well as on the AE website at:
https://www.sjsu.edu/ae/programs/msae/syllabi.php

Course and Contact Information

Instructor(s):	Professor Sean Montgomery
Email:	sean.montgomery@sjsu.edu
Office Location:	See CANVAS course syllabus section for office hours Zoom link
Office Hours:	Tuesdays and Thursdays 7:30 pm to 8:00 pm
Class Days/Time:	Tuesdays and Thursdays 6:00 pm to 7:15 pm
Classroom:	Online
Writing Assistance:	Dr. Radha Aravamudhan radha.aravamudhan@sjsu.edu
Prerequisites:	Graduate standing in AE or instructor consent
GE/SJSU Studies Category:	This course satisfies the Graduate Writing Assessment Requirement (GWAR)

Course Description

This is a project course in which students design and analyze aircraft subsystems: flight controls; avionics and electrical; cabin systems; landing gear and other mechanical systems. Students also perform a systems safety analysis.

Course Goals

1. To familiarize students with aircraft subsystems operation, analysis, design, safety, and interdependencies.
2. To study design implementations of aircraft subsystems in a variety of aircraft types including historic and modern aircraft.
3. To develop design skills by designing all the subsystems for an aircraft.
4. To develop technical writing ability.

Course Learning Outcomes (CLO)

Students completing AE273 should be able to analyze and design the following subsystems for various types of aircraft:

1. Flight control systems.
2. Avionics and electrical systems.
3. Cabin systems.
4. Landing gear systems.
5. Fuel systems.
6. Hydraulic systems.
7. Environmental systems.
8. Analyze system safety for the above subsystems.

Students must also communicate the results of their design in a comprehensive, well written final report, following APA guidelines.

Required Texts

Roskam, J. (2017). *Airplane Design Part IV: Layout of Landing Gear and Systems.* DARcorporation, Lawrence, Kansas 66046, USA.
The volume with the green cover. Kindle edition available on Amazon.

Moir, I. & Seabridge, A. (2008). *Aircraft Systems: Mechanical, electrical, and avionics subsystems integration.* 3rd ed. Wiley.
The SJSU library has a digital copy available for students.

Roskam, J. (2007). *Lessons learned in aircraft design. The devil is in the details.* DARcorporation, Lawrence, Kansas 66046, USA.

Course Requirements and Assignments

Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally three hours per unit per week) for instruction, preparation/studying or other course related activities.

The course will be divided into two parts. In the first part, students will conduct detailed research on the subsystems for one or two aircraft and share their research in class through presentations. For the second part of the course, students will ***individually design*** the subsystems of an aircraft and write reports for their design, culminating in a final comprehensive report and presentation. The final report must be a ***minimum of 4,000 words*** (not including figures, tables, appendices) and follow the APA format.

This course must be taken for a letter grade to fulfill the GWAR. Reports are graded for English (grammar, spelling, punctuation, etc.) as well as technical content. ***Students must meet with Dr. Aravamudhan to have their papers reviewed for feedback prior to final submission.*** Email her to make an appointment anytime during the semester. Written reports not meeting minimum writing

proficiency standards will be returned without a grade. Please see attached general guidelines for professional reports.

Grading:

5% Quizzes
5% Systems assignments
5% Lessons learned assignments
5% Design peer evaluations
10% Design progress assignments
10% Design presentation(s)
30% Research presentations/reports
30% Final design report (***4,000 words minimum***)

Grading Scale:

A+	>	97%
A	>	93%
A-	90% - 93%	
B+	87% - 90%	
B	83% - 87%	
B-	80% - 83%	
C+	77% - 80%	
C	73% - 77%	
C-	70% - 73%	
D	60% - 70%	
F	<	60%

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 at http://www.sjsu.edu/gup/syllabusinfo/
AE Department Policies and SJSU policies are posted at
http://www.sjsu.edu/ae/programs/policies/

For issues related to Canvas, please contact the eCampus Help Desk.
Phone: (408) 924-2337
Submit a help ticket using the following URL:
https://isupport.sjsu.edu/ecampus/ContentPages/Incident.aspx
While logged into Canvas, click on the word Help on the upper right corner of the screen.

AE 273 – Aircraft Subsystems – Spring 2022 – Course Schedule

Week / Module	Date	Topic	Assignment Due
1		Hydraulic systems	
2		Flight control systems	
3		Landing gear systems	Hydraulic, flight control, and landing gear systems research presentation/report
4		Engine systems Fuel systems	
5		Pneumatic systems Weather protection systems	
6		Electrical systems	Engine, fuel, pneumatic, and weather protection systems research presentation/report
7		Avionic systems Interior systems	
8		Emergency systems	Electrical, avionic, interior, and emergency systems research presentation/report
9		Hydraulic systems lessons learned Flight control systems lessons learned	
10		Landing gear systems lessons learned Engine systems lessons learned	Hydraulic, flight control, and landing gear system designs due
11		Fuel systems lessons learned Pneumatic systems lessons learned	
12		Weather protection systems lessons learned Electrical systems lessons learned	Engine, fuel, pneumatic, and weather protection system designs due
13		Avionic systems lessons learned Interior systems lessons learned	
14		Emergency systems lessons learned	Electrical, avionic, interior, and emergency system designs due
15		Design review/presentations	
16		Design review/presentations	
17		**Final Presentations**	

GUIDELINES FOR GWAR & MSAE PROJECT REPORTS

1. Reports must be written in **good English** (grammar, spelling, punctuation, etc.). Reports not meeting minimum writing proficiency standards will not be graded.
2. Reports must be prepared in **Microsoft Word.**
3. Use a **one-column format.**
4. Font: **Times New Roman 12 point**, unless a different size is specified (headings, etc.).
5. **Line spacing**: single.
6. **Margin**: **one inch** minimum on all pages including graphs, figures, tables, computer print-outs, etc.
7. **Title page**: follow the template on the next page.
8. **Copyright page:** immediately following the title page (see template after title page); page number: ii (suppressed).
9. **Abstract:** see template below; page number: iii.
10. **Acknowledgements;** page number: iv.
11. **Table of Contents:** page number: v.
12. **List of Figures:** page number: vi.
13. **Symbols:** page number: vii.
    Define all symbols used anywhere in the report (including figures, appendices, etc.). Do not include symbols which
    are not used in your report! Do not copy a list of symbols from another reference! The list of symbols must be presented in the following manner:

Symbol	**Definition**	**Units (SI)**
W	Weight	lbs (N)
Greek Symbols		
α	Angle of attack	deg or rad
Subscripts		
$()_{TO}$	Takeoff	-------
Acronyms		
APU	Auxiliary Power Unit	-------

14. Use a **decimal numbering system** to organize your report. Chapters, sections, sub-sections should be indicated as follows:

    4. Title of Chapter (16 pt.)

    4.1 Title of Section (14 pt.)

    4.1.1 Title of Sub-Section (12 pt.)

    1.1.1.1 Title of sub-sub-section (12 pt.)

    Allow sufficient space below headings and subheadings.

15. Each chapter starts on a **new page**.
16. All pages must be numbered. Start Chapter 1 at page 1.

The Design of a Five-Passenger, Electric, Vertical Takeoff and Landing, Supersonic, Personal Aerial Vehicle (28 point bold)

a project presented to
The Faculty of the Department of Aerospace Engineering
San José State University (12 point)

in partial fulfillment of the requirements for the degree (12 point)
***Master of Science in Aerospace Engineering** (14 point bold italics)*

by (12 point)

Meticulous D. Oriented (18 point bold)

December 2013 (12 point)

approved by (10 point)

Dr. Willcheck E. Forsure (12 point)
Faculty Advisor (10 point)

San José State
UNIVERSITY

ABSTRACT

The Design of a Five-Passenger, Electric, Vertical Takeoff and Landing, Supersonic, Personal Aerial Vehicle

Meticulous D. Oriented

17. **Calculations**:
    i. At least one “hand” calculation must be performed and documented for each case in a separate sub-section.
    ii. Hand-calculations do not have to be typed but should be clearly written and well organized.
    iii. Lengthy calculations (more than 2 pages), should be placed in an appendix but the results should be discussed in the main body of the report.
18. **Derivations:**
    i. Do not put lengthy derivations in the main body of the report; put them in an appendix (or appendices) and summarize the result in the main part of the report.
19. **Avoid sentences longer than 2 lines,** otherwise your report will have a high ***"Fog Index"*** (i.e. it will be difficult to read).
20. **Do not** use I, you, we, they, etc. in a technical report.
21. **Do not** treat an airplane, a spacecraft or any other artifact for that matter as a person, i.e., **do not write**: *the airplane's landing gear is retractable.* Instead, write: *the landing gear of the airplane is retractable* or *the airplane has a retractable landing gear.*
22. **Do not** use the words: 'in order to ...'; the words 'in order' are nearly always out of order! In 99% of the cases, you can leave out the words ‘in order to…’ without losing any clarity.
23. **Bulletize.** Instead of: *in this chapter, the results of calculations of wing-loading, maximum lift coefficients, thrust-to weight ratio, lift-to-drag ratio and cruise lift coefficients are presented.*
    Write: *In this chapter the following characteristics of the Spartan Jet are presented:*
    - *Wing Loading*
    - *Maximum Lift Coefficients*
    - *Thrust-to-Weight Ratio*
    - *Lift-to-Drag Ratio*
    - *Cruise Lift Coefficient*
24. **Equations** must be numbered sequentially. Within a chapter use a decimal numbering system. For example:

$$X = Y + Z \tag{4.17}$$

25. **References** must be listed following AIAA rules (see attached examples).

26. **Figures:**
    i. Must be numbered sequentially.
    ii. Must have descriptive **captions below** each figure.
    iii. Axes must have a scale and descriptive labels including units whenever appropriate.
    iv. Curves must have descriptive labels.
    v. All lettering must be at least 3 mm high to be legible!
    For example:

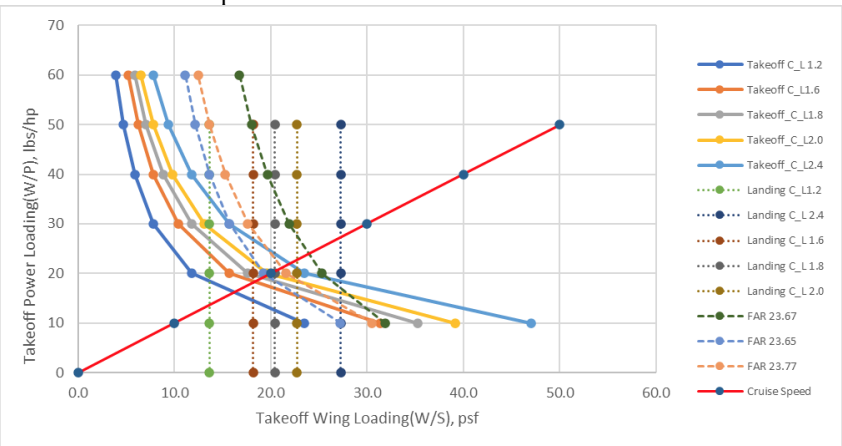

Figure 3.1 – Figure 10. Matching graph for the proposed aircraft.

27. **Tables**:
    i. Must be numbered sequentially.
    ii. Have descriptive **headings above** each table.
    iii. All lettering must be at least 3 mm high to be legible!
    For example:

Table 5.1 – Specific energy density for various types of batteries [15].

Battery	Theoretical Value	Expected in the next 5-10 years
Li-Ion	390 Wh/kg	250 Wh/kg
Zn-air	1090 Wh/kg	400-500 Wh/kg
Li-S	2570 Wh/kg	500-1250 Wh/kg
Li-O_2	3500 Wh/kg	800-1750 kg

28. When presenting **aerodynamic data** in a table, graph or figure, you must include the following information:
    i. Reference geometries: S, c and b in ft (or inches) and m (or cm).
    ii. Moment center information in fractions of the mgc (mean geometric chord).
    iii. Airplane weight consistent with the presentation of the data.
    iv. Airplane configuration information, such as:
        - Clean
        - Flaps down, gear up
        - Flaps down, gear down
        - Thrust or power setting
        - Speed brake deployment
        - Flight condition
        - cg location in fractions of the mgc (mean geometric chord)
29. **Tables, graphs** and **figures** are much easier to understand than **prose,** so use them as much as possible.
30. **Plagiarism** will result in **total loss of credit for the entire report**! If you decide to use material, which was not generated by you, clearly identify the source of such material.
31. **Do not** make **unsubstantiated claims**! Example: if you claim that you have optimized airplane weight, you are expected to prove it. If you cannot prove it, do not make the claim!
32. **Avoid** using **superlatives, (**e.g. *this is the best airplane ever designed or the wing area selected is the smallest possible for this type of airplane*).
33. If you **extrapolate** data or if you extrapolate existing technology, discuss the consequences to your design of not being able to achieve the extrapolated characteristics.
34. Include **units** (both systems) with all your results.
35. **Appendices** must:
    i. Be sequenced using capital letters
    ii. Have specific, descriptive titles.
    For example:
    Appendix A - Hand Calculations for Sensitivity Studies
    Appendix B – Flow Chart for Boundary Layer Integration CODE