San José State University
Department of Aviation and Technology
Aviation 31, Aircraft Theory & Design
Spring 2017

Instructor:	Mr. Dennis Romano
Office Location:	RHV Faculty Office
Email:	Dennis.Romano@sjsu.edu
Office Hours:	Tuesdays 1415-1445 Thursdays 1115-1145, other times by arrangement
Class Days/Time:	Lecture: Tuesdays 1200-1345 Lab (Section -12): Tuesdays 1500-1745 Lab (Section -11): Thursday 1200-1445
Classroom:	Lecture: Industrial Studies 216 Lab: RHV
Prerequisites:	Avia 2, Physics 2A, Math 71
Co-requisite:	Physics 2B

Lecture slides presented in class and other course material (including homework assignments and solutions) will be posted on Canvas. The material will normally be posted the evening of the class meeting in which it was discussed.

Course Description

Aerodynamics and aeroelastic forces, load and stress analysis of flight vehicles, aircraft design optimization, material selection along with, safe-life, fail-safe and damage tolerance in design. Successful completion of Physics 2A and Math 71 are prerequisites for this course.

Course Learning Outcomes (CLO)

At the end of the semester, the student will be able to:

- Use the fundamentals of aerodynamics and the application of the basic laws of physics to analyze problems in aerodynamics
- Describe how aerodynamic forces originate in flight
- Analyze how the forces are conventionally defined
- Analyze how forces combine to determine airplane's performance and stability
- Describe the pitot-static concepts and how these pressures are correlated to the instrumentation readings.
- Describe aircraft structural design; such as material selection, safe-life, and damage tolerance design philosophies as these relate to aerodynamics.

Course Content

1. The Standard Atmosphere
2. Lift and Drag
3. Reynolds Number, Airfoil Data
4. Viscous Flow and the Boundary Layer
5. High Lift Devices
6. Lift, Drag, Thrust and Power Calculations
7. Wind Tunnel and Experimental Verification
8. Aircraft Performance, Stability and Control
9. Rotary Wing and Vertical Lift Technology
10. Aircraft Materials and Selection
11. Structural Design and Analysis
12. Aircraft Design Philosophies and Verification Methodologies
13. The Design Process and Systems Engineering

Required Text

Fundamentals of Flight, Second edition, Richard S. Shevell, Prentice Hall, ISBN 0-13-339060-8.

Other reading from: *NASA Systems Engineering Handbook*, NASA/SP-2007-6105, 2007, http://hdl.handle.net/2060/20080008301

Recommended reading (not required): *Aerodynamics for Naval Aviators*, H.H. Hurt, Jr., January 1965, available at: http://www.faa.gov/regulations_policies/handbooks_manuals/aviation/media/00-80t-80.pdf

The text will be augmented by other material, including the following for the part of the course primarily devoted to aerodynamics:

1. *Introduction to Flight*, John D. Anderson, Jr., Sixth Edition, 2008
2. *Theory of Flight*, Richard von Mises, 1959
3. *Theory of Wing Sections: Including a Summary of Airfoil Data*, Ira H. Abbott and Albert E. von Doenhoff, 1959
4. *Aircraft Design: A Conceptual Approach*, Daniel P. Raymer, Fourth Edition, 2006
5. *Sikorsky Helicopter Flight Theory for Pilots and Mechanics*, John R. Montgomery, Sikorsky Aircraft, 1964

The third section of the course (after the second mid-term) will rely on material presented in class lectures primarily from the following sources:

1. *Airframe Structural Design*, Michael C. Y. Niu, 1997
2. *MIL-HDBK-5J, Metallic Materials and Elements for Aerospace Vehicle Structures*, 2003
3. *NASA Systems Engineering Handbook*, NASA/SP-2007-6105, 2007
4. *Design for Safety*, David B. Thurston, 1980
5. *Structural Integrity of New and Aging Metallic Aircraft*, Course Notes, UCLA Extension, 1997
6. *Airframe Design and Repairs*, Course Notes, UCLA Extension, 1998
7. *Burt Rutan's Race To Space*, Dan Linehan, 2011

Course Requirements and Assignments

Homework will be due one week after it is assigned unless otherwise noted. **Late homework will not be accepted**, as it will be discussed in class the day it is due. If you cannot attend class the day that a homework assignment is due, it may be emailed to the instructor prior to the start of the class in which it was due. Homework assignments must be typed, unless otherwise noted. Some assignments will involve mathematical analysis/equations; these can be neatly handwritten. On those assignments, it is preferred that any written discussion or analysis be typed; the math can be neatly handwritten. Completed work must be neat, legible and logical. This requirement is for both homework and lab assignments. All labs will count toward the final grade; the homework assignment with the lowest grade will be dropped.

Examinations: There will be two mid-term exams and a final examination. There will be no make-ups for missed exams, unless a written medical excuse is provided. **Laptops, cell phones and notes are not allowed during exams.**

Grading Policy

Evaluation:

	Percentage
Research Assignment	15%
Homework Problems	10%
Labs	15%
2 Mid-term Exams	30%
1 Final Exam	30%
TOTAL	**100%**

Note: The Research Assignment will be presented to the class. 1/3 of the grade for the research assignment will be based on the presentation. Thus, the Research Assignment grading overall will be 10% for the written paper and 5% for the class presentation. Each student will choose their research assignment topic and it must be related to the Course Learning Outcomes; the topic requires instructor approval.

The first two mid-term exams will cover the material discussed during that portion of the course. The final exam will cover the entire course, focusing on the material discussed after the second mid-term.

Average	**Grade**
94-100	A
90-93	A-
87-89	B+
83-86	B
80-82	B-
77-79	C+
73-76	C
70-72	C-
60-69	D
below 60	F

Note: Grading will be based on either the percentages noted above, or pending overall class performance, the instructor may elect to apply a grading curve.

Classroom Protocol

To facilitate learning, **please have all cell phones on "silent" during class**. Please **do not send text messages during class,** as this is a distraction to you and the other students. Computers may be used for taking notes, but other uses are a distraction and not permitted. No food is allowed in the classroom or lab. Students are expected to attend class regularly, arrive on time and be prepared to participate. For safety, closed toe shoes are required for any lab activities in the aircraft hangar or airport parking ramp areas.

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/

Consent for Recording of Class and Public Sharing of Instructor Material

University Policy S12-7, http://www.sjsu.edu/senate/docs/S12-7.pdf, requires students to obtain instructor's permission to record the course.

- Common courtesy and professional behavior dictate that you notify someone when you are recording him/her. You must obtain the instructor's permission to make audio or video recordings in this class. Such permission allows the recordings to be used for your private, study purposes only. The recordings are the intellectual property of the instructor; you have not been given any rights to reproduce or distribute the material.
    - Contact the instructor if you wish permission to record any part of the course.

- Course material developed by the instructor is the intellectual property of the instructor and cannot be shared publicly without his approval. You may not publicly share or upload instructor generated material for this course such as exam questions, lecture notes, or homework solutions without instructor consent.

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Course Schedule

Note that this schedule is subject to change. I will attempt notify everyone not later than the class or lab meeting prior to the change, via email, or both. The labs will normally relate to and support the preceding lectures.

Week	Date	Topics	Text/Assignment
0	1/26	Lab Section -11 meets	
1	1/31	Introduction, Design Requirements, Mechanics, History, Atmospheric Properties, Wind Tunnels, Bernoulli's Principle, Forces	pp. 1-91
2	2/7	Lift and Drag, Airfoils: Description, Characteristics, Forces	pp. 118-135, 158-188, 218-234
3	2/14	Wing Planform Effects, High Lift Devices →***Proposed Research Paper Topic Due***	pp. 137-156, 188-191, 235-255
4	2/21	Propulsion	pp. 332-358, 365-371
5	2/28	Steady State Flight, Range, Endurance, Climb, Landing	pp. 256-303
6	3/7	Maneuvering Performance	pp. 319-324
7	3/14	**Mid-term Exam 1**– Material from Weeks 1-4 Stability and Control	pp. 306-319, 324-329
8	3/21	Transonic and Supersonic Flight	pp. 92-115, 193-216, 224
9	3/28	***Spring Recess***	
10	4/4	Rotorcraft and Vertical Flight →***Research Papers Due*** →***Research Paper Presentations to class begin***	Lecture Notes

11	4/11	Aircraft Materials and Selection	Lecture Notes
12	4/18	Structural Design and Analysis	pp. 373 – 394, Lecture Notes
13	4/25	Aircraft Design Philosophies: Safe Life, Fail Safe, Damage Tolerance	Lecture Notes
14	5/2	**Mid-term Exam 2** – Material from Weeks 5-11 The Design Process	Lecture Notes & reading assignment noted below
15	5/9	Systems Engineering	
16	5/16	Last day of class: Course Wrap-up & Final exam review No lab	
17	**5/24 (Wed)**	**FINAL EXAM – 0945-1200**	

Reading assignment for week 14 is in the *NASA Systems Engineering Handbook*, NASA/SP-2007-6105, 2007, as follows:
http://hdl.handle.net/2060/20080008301

pp. 1-21
pp. 31-32
Section 4.1.2.1 (pp.35-37)
p. 40
pp. 55-62 (up to section 4.4.2)
pp. 62-66 (skim)
p. 111
pp. 119-120 (from "prepare the SEMP" through "role of the SEMP")
P. 127, right column
p. 151