San José State University
Department of Aviation and Technology
Avia 193-01, Aircraft Aerodynamics, Lecture Course No. 41548, Tuesday Lab 40401, Thursday Lab 47208, Fall 2016

Instructors:	Dr. Paul Kutler Dr. Francesca Favaro
Office Location:	Engineering 348
Telephone:	408.482.1028
Email:	pkutler@comcast.net
Office Hours:	Tuesday & Thursday, 3:15-4:15 PM
Class Days/Time:	Tuesday 8:00-8:45 AM Lecture Thursday 8:00-8:45 AM Lecture Tuesday 9:00-11:45 Laboratory Thursday 9:00-11:45 Laboratory
Classroom:	Clarke 202 Lecture IS 133 Laboratory
Prerequisites:	Avia 31, Physics 2A, Math 71

Faculty Web Page and MYSJSU Messaging

My faculty web page is at http://www.engr.sjsu.edu/pkutler/ . You are responsible for regularly checking with the messaging system through MySJSU and your email account for messages and your class status.

Course Description

This course will cover the history of early pioneers in aeronautics and their flight vehicles. It will present a review of fundamental physical quantities of flowing gases. The "standard atmosphere" will be introduced along with its application in solving problems associated with the flight and behavior of aircraft. Basic aerodynamics concepts will be presented for both low- and high-speed flight. Incompressible and compressible flows, and inviscid and viscous flow will be discussed. The lift, drag and moment associated with flight vehicles will be presented.

Course Goals and Student Learning Objectives

Course Goals

To give students an understanding of:
G1: Fundamental equations that determine the aerodynamics of airfoils and wings
G2: The equations describing the behavior of gases
G3: The purpose and operation of subsonic and supersonic wind tunnels
G4: The discipline of computational fluid dynamics and how it can be used to simulate the flow about aerospace vehicles
G5: The aerodynamic properties of airfoils and wings for subsonic and supersonic flows
G6: Viscous flow, including both laminar and turbulent, about simple aerodynamic shapes

Course Content Learning Outcomes

Upon successful completion of this course, students will be able to:

LO1: Describe the aerodynamic forces acting on aerospace vehicles
LO2: Describe the governing gas-dynamic equations and state variables.
LO3: Describe the characteristics of The Standard Atmosphere
LO4: Describe the basic operation of both subsonic and supersonic wind tunnels
LO5: Describe the process involved in solving the gas-dynamic equations using numerical methods
LO6: Describe the differences between incompressible and compressible flows
LO7: Describe the behavior of simple viscous laminar and turbulent flows
LO8: Describe the aerodynamic coefficients of lift, drag, and moment and their relationship to wings
LO9: Describe the fundamental aerodynamic differences between infinite and finite wings
LO10: Describe the benefits of wing flaps
LO11: Describe unique characteristics for supersonic vehicles such as wave drag
LO12: Describe the unique properties of swept wings

Required Texts/Readings

Textbook

Introduction to Flight; 8th Edition, Anderson, John D., McGraw-Hill, 2016.

Classroom Protocol

Students are required to apply math, physics and engineering knowledge to identify, formulate and solve problems involving aircraft aerodynamics. They should work in teams to solve problems in and outside of class. Teams will work together to perform laboratory experiments and computations and to present their research results to their classmates. Students are responsible to study the course material and solve problems without the benefit of a class discussion/lectures. They will have to search the World Wide Web for additional material on topics related to aircraft aerodynamics. The

students should collaborate in small groups to discuss and prepare homework. The homework should be turned in on time. Students should seek advice when stumped and not let confusion mount.

Dropping and Adding

Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Refer to the current semester's Catalog Policies section at http://info.sjsu.edu/static/catalog/policies.html. Add/drop deadlines can be found on the current academic calendar web page located at http://www.sjsu.edu/academic_programs/calendars/academic_calendar/. The Late Drop Policy is available at http://www.sjsu.edu/aars/policies/latedrops/policy/**.** Students should be aware of the current deadlines and penalties for dropping classes.

Information about the latest changes and news is available at the Advising Hub at http://www.sjsu.edu/advising/.

Assignments and Grading Policy

Grading is performed on the basis of individual student achievement. A student's grade is determined based on the following grading components:

- Homework……...15%, 5 points for each problem worked
- In-class problems…….10%, 10 points each
- Lab reports……...15%, 25-60 points each
- Midterms……..……30%, 100 points each
- Final……..…30%, 300 points
- Extra credit problems will be available to supplement these points

Total: Approximately 1000 points
Grade Distribution:
899 points < A-, A, A+ < 1,001 points
799 points < B-, B, B+ < 900 points
699 points< C-, C, C+ < 800 points
599 points < D-, D, D+ <700 points
F< 600 points

Student's status in the class will be periodically emailed to them throughout the semester to preclude surprises near the end of the semester.

Homework: Problem solutions are due one week after their assignment unless otherwise noted. Late homework will not be accepted.

In-class problems: These will be worked in groups of 3-4 people and assigned near the end of class and due before leaving. They will cover material presented in class during the lectures and assigned as reading before the lectures.

Laboratory Experiments: There will be seven experiments performed throughout the semester. These will be worked in groups of 5-6 people. They will be performed in the small, low-speed wind tunnel. Written and oral reports will be required for each experiment performed.

Examinations: There will be two midterm exams and a final examination. All tests will be open book and open notes. There will be no make-ups for missed tests, unless special arrangements are made with the instructor.

University Policies

Academic integrity

Your commitment as a student to learning is evidenced by your enrollment at San Jose State University. The University's Academic Integrity policy, located at http://www.sjsu.edu/senate/S07-2.htm, requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development. The Student Conduct and Ethical Development website is available at http://www.sa.sjsu.edu/judicial_affairs/index.html.

Instances of academic dishonesty will not be tolerated. Cheating on exams or plagiarism (presenting the work of another as your own, or the use of another person's ideas without giving proper credit) will result in a failing grade and sanctions by the University. For this class, all assignments are to be completed by the individual student unless otherwise specified. If you would like to include your assignment or any material you have submitted, or plan to submit for another class, please note that SJSU's Academic Policy S07-2 requires approval of instructors.

Campus Policy in Compliance with the American Disabilities Act

If you need course adaptations or accommodations because of a disability, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Presidential Directive 97-03 requires that students with disabilities requesting accommodations must register with the Disability Resource Center (DRC) at http://www.drc.sjsu.edu/ to establish a record of their disability.

Student Technology Resources

Computer labs for student use are available in the Academic Success Center located on the 1st floor of Clark Hall and on the 2nd floor of the Student Union. Additional computer labs may be available in your department/college. Computers are also available in the Martin Luther King Library.
A wide variety of audio-visual equipment is available for student checkout from Media Services located in IRC 112. These items include digital and VHS camcorders, VHS and Beta video players, 16 mm, slide, overhead, DVD, CD, and audiotape players, sound systems, wireless microphones, projection screens and monitors.

Learning Assistance Resource Center

The Learning Assistance Resource Center (LARC) is located in Room 600 in the Student Services Center. It is designed to assist students in the development of their full academic potential and to motivate them to become self-directed learners. The center provides support services, such as skills assessment, individual or group tutorials, subject advising, learning assistance, summer academic preparation and basic skills development. The LARC website is located at http:/www.sjsu.edu/larc/.

SJSU Writing Center

The SJSU Writing Center is located in Room 126 in Clark Hall. It is staffed by professional instructors and upper-division or graduate-level writing specialists from each of the seven SJSU colleges. Our writing specialists have met a rigorous GPA requirement, and they are well trained to assist all students at all levels within all disciplines to become better writers. The Writing Center website is located at http://www.sjsu.edu/writingcenter/about/staff/.

Peer Mentor Center

The Peer Mentor Center is located on the 1st floor of Clark Hall in the Academic Success Center. The Peer Mentor Center is staffed with Peer Mentors who excel in helping students manage university life, tackling problems that range from academic challenges to interpersonal struggles. On the road to graduation, Peer Mentors are navigators, offering "roadside assistance" to peers who feel a bit lost or simply need help mapping out the locations of campus resources. Peer Mentor services are free and available on a drop –in basis, no reservation required. The Peer Mentor Center website is located at http://www.sjsu.edu/muse/peermentor/

Avia 193 / Aircraft Aerodynamics, Fall 2016,

Course Schedule

Table 1 Course Schedule

Week	Date	Topics, Readings, Assignments, Deadlines
1	8/25	**Lecture**: **Lecture & Lab Greensheet** , History, Chapter 1, pp 1-51, Aerodynamics Seminar Overview, Part 1 **Lab Section 2** Experiment 1 Intro, Aerodynamics Seminar, Part 2 **Homework:** None
2	8/30 & 9/1 8/30 9/1	**Lecture:** Aerodynamics Seminar Overview, Part 1 (Concluded), Fundamental Thoughts, Chapter 2; pp 53-82; The Standard Atmosphere, Chapter 3, pp 110-131 **Lab Section 1:** Experiment 1 Intro, Aerodynamics Seminar, Part 2 **Lab Section 2:** Experiment 1 Presentations, Experiment 2 Intro **Homework:** Handout Problems 2.1, 2.2, 2.3, 2.4, 3.1, & 3.2; **Due 9/8**
3	9/6 & 9/8 9/6 9/8	**Lecture:** Continuity, Momentum, Energy, Chapter 4; pp 134-173; **Lab Section 1:** Experiment 1 Presentations, Experiment 2 Intro **Lab Section 2:** Experiment 2 Execution **Homework:** Problems 4.1, 4.2, 4.3, 4.4; **Due 9/15**
4	9/13 & 9/15 9/13 9/15	**Lecture:** Speed of Sound, Low-Speed W/T's, Measurement of Airspeed, Chapter 4, pp 173-210 **Lab Section 1:** Experiment 2 Execution **Lab Section 2**: Experiment 2 Presentations, Experiment 3 Intro **Homework:** Problems 4.5, 4.6, 4.7, 4.8; **Due 9/22**
5	9/20 & 9/22 9/20 9/22	**Lecture: Review; Midterm 1 (9/22)** **Lab Section 1:** Experiment 2 Presentations, Experiment 3 Intro **Lab Section 2:** Experiment 3 Execution
6	9/27 & 9/29 9/27 9/29	**Lecture:** Additional Considerations, Supersonic Flow, Compressibility, Chapter 4; pp 210-227; **Lab Section 1:** Experiment 3 Execution **Lab Section 2:** Experiment 3 Presentations, Experiment 4 Intro **Homework:** Problems 4.9, 4.10; **Due 10/6**
7	10/4 & 10/6 10/4 10/6	**Lecture:** Viscous Flow, Laminar & Turbulent Boundary Layers, Chapter 4; pp 227-244 **Lab Section 1:** Experiment 3 Presentations, Experiment 4 Intro **Lab Section 2:** Experiment 4 Execution **Homework:** Problems 4.11; **Due 10/13**
8	10/11 & 10/13 10/11 10/13	**Lecture:** Compressibility Effects, Transition, Separation, Chapter 4; pp 244-258 **Lab Section 1:** Experiment 4 Execution **Lab Section 2:** Experiment 4 Presentations, Experiment 5 Intro **Homework:** None

Week	Date	Topics, Readings, Assignments, Deadlines
9	10/18 & 10/20 10/18 10/20	**Lecture:** Nomenclature, Lift, Drag & Moment Coefficients, Airfoil Data, Chapter 5; pp 288-315 **Lab Section 1:** Experiment 4 Presentations, Experiment 5 Intro **Lab Section 2:** Experiment 5 Execution **Homework:** Problems 5.1, 5.2; **Due 10/27**
10	10/25 & 10/27 10/25 10/27	**Lecture: Review, Midterm 2 (10/27)** **Lab Section 1:** Experiment 5 Execution **Lab Section 2:** Experiment 5 Presentations, Experiment 6 Intro
11	11/1 & 11/3 11/1 11/3	**Lecture:** Infinite versus Finite Wings, Pressure Coefficient, Compressibility Correction, Chapter 5; pp 315-327 **Lab Section 1:** Experiment 5 Presentations, Experiment 6 Intro **Lab Section 2:** Experiment 6 Execution **Homework:** Problems 5.3, 5.4, 5.5, 5.6; **Due 11/5**
12	11/8 & 11/10 11/8 11/10	**Lecture:** Drag Divergence Mach Number, Wave Drag, Summary, Chapter 5; pp 349-359 **Lab Section 1:** Experiment 6 Execution **Lab Section 2:** Experiment 6 Presentations, Experiment 7 Intro **Homework:** Problems 5.7, 5.8, 5.9, 5.10; **Due 11/17**
13	11/15 & 11/17 11/15 11/17	**Lecture:** Finite Wings, Induced Drag, Lift Curve Slope, Swept Wings, Chapter 5; pp 359-385 **Lab Section 1:** Experiment 6 Presentations, Experiment 7 Intro **Lab Section 2:** Experiment 7 Execution **Homework:** Problems 5.11, 5.12, 5.13; **Due 11/29**
14	11/22 & 11/24 11/22 11/24	**Lecture:** Flaps, Aerodynamics of Cylinders and Spheres, Production of Lift, Chapter 5; pp 394-415**, Thanksgiving: No class** **Lab Section 1:** Experiment 7 Execution **Lab Section 2: Thanksgiving: No class** **Homework:** Problems 5.14, 5.15; **Due 12/3**
15	11/29 & 12/1 11/29 12/1	**Lecture:** Flaps, Aerodynamics of Cylinders and Spheres, Production of Lift (Concluded) **Lab Section 1:** Experiment 7 Presentations **Lab Section 2:** Experiment 7 Presentations
16	12/6 & 12/8 12/6 12/8	**Lecture: Review** **Lab Section 1:** Possible NASA Ames Visit, Experimental Facilities **Lab Section 2:** Possible NASA Ames Visit, Experimental Facilities
	12/14	**Final Exam, 7:15-9:30 AM, Clarke 202**

Important Dates:
Sept. 5, 2016: Labor Day
Nov. 11, 2016: Veterans Day
Nov. 24-25, 2016: Thanksgiving Holiday

Dec. 12, 2016: Last day of instruction
Final Exam: Wednesday, December 14, 2015; 7:15-9:30 AM

This schedule is subject to change and you will be notified via email or during classroom lecture of any changes.

Approach to Success

- Before coming to class, read assigned sections from textbook and jot down any questions you have over the material you've read.
- Work through the example problems provided in the text and jot down any questions you have about the example problems.
- Come to class and take notes during the lecture not only on what's written on the board but also on what's spoken in class.
- Ask questions in class about any confusing material.
- Work the homework problems, both in the textbook and the supplemental problems.
- Come to office hours with any additional questions you have about the theory or problems.
- Use study groups to help with understanding the material and solving the homework problems.

Suggested Written Paper Outline

I. Title/Authors/Affiliation (i.e., Civil, Mechanical, Aerospace Engineering)
II. Abstract
III. Introduction
IV. Approach
V. Analysis
VI. Results
VII. Conclusions/Summary/Future Directions
VIII. References
IX. Acknowledgements

Suggested Oral Presentation Outline

I. Introduction
II. Approach
III. Analysis
IV. Results
V. Conclusions

- PowerPoint slides using the computer or overhead projection system should be used
- Each group member should perform part of the presentation