

California State University, Chico
College of Engineering, Computer Science, and Construction
Management
Mechanical and Mechatronic Engineering and Advanced
Manufacturing

MECH 435, Low Speed Aerodynamics, Section 01, Spring 2021

Instructor:	Associate Professor David G. Alexander
Office location:	O'Connell (OCNL) 422 Zoom: https://csuchico.zoom.us/j/97824336029?pwd=dkFzdKNXNEFieHQrREVYc2hWc1pIZz09
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Office hours:	See MMEM Department Faculty and Staff website and current semester schedule or by appointment
Class days and times:	Lecture: Tue and Thu 12:30 AM – 1:45 PM
Classroom:	Online and Synchronous: Zoom link - https://csuchico.zoom.us/j/99761780479?pwd=dys3ejJVUEtVZUc3ZWVHYXU4SFd6UT09 Laboratory: LANG 122
Prerequisites:	MATH 260 – Differential Equations and CIVL 321 – Fluids Recommended: MECH 306 – Equation Solving Techniques

Overview

We will apply physical and mathematical concepts of aerodynamics to analyze and design air flow around automobiles, airplanes, and wind turbines.

How to Succeed in this Class

Learning is the process of creating new connections in the brain. Building these connections takes time and effort. At times, the effort to create these connections will cause one to get frustrated and feel like learning is a hopeless struggle. This is normal. Eventually, the brain creates enough connections that new information can be quickly and efficiently accessed and used. When this happens a powerful set of tools will be available for understanding, analyzing, and solving immensely diverse and important problems.

Succeeding in this class and succeeding in college in general has been researched extensively. There are known behaviors, situations, and attitudes that directly relate to student success.

A powerful attitude or understanding that significantly improves student success is based on the idea that intelligence does not predetermine one's abilities or level of mastery in anything. In fact, believing that intelligence will lead to a high level of achievement and understanding is negatively correlated with success. Watch the following educational research-based video on this topic, <https://youtu.be/2nF90sAW-Yg>. Take this quiz, <https://youtu.be/3vz6HU1LI0U>.

I believe that everyone in my class is fully capable of succeeding at their highest level and that they belong in my class and at the university. I never thought that I would be a college professor. In fact, here is a short video that I made a couple years ago during a teaching workshop about my path to becoming a professor, <https://youtu.be/uxLUj7jD6Ws>.

Here is some practical advice for succeeding in class. A minimum of 3 hours of outside class work is required for every 1 hour of in-class work for most upper-division engineering courses. A total of 12 hours should be scheduled outside of class every week for this course. Combined with the hours spent in class, a total of 16 hours per week should be dedicated to studying energy systems to make it possible to earn a C or better grade. If an engineering student is taking four engineering classes, a total of 48 hours per week should be set aside in order to do well in all classes. If one does not have these many hours because of work or other obligations, then one's level of understanding and grades will likely suffer. So, there is a choice to be made.

Course Description and Goals

Catalog Description

Flow around elementary shapes, concepts of flow circulation, lift and drag. Incompressible inviscid flows around thin airfoils and wings of finite span.

Course Goals

Develop and apply the conservation equations that describe fluid flow at speeds up to about 0.3 Mach. Use ANSYS Fluent to analyze complex flow problems and troubleshoot where the analysis might be losing accuracy or reaching its effective limits.

Student Learning Outcomes

1. Understand what a fluid is and characterize fluid regimes, types of flow, and properties of flows and/or fluids.
2. Be able to setup a fluids problem from a given physical scenario and apply appropriate assumptions and boundary conditions that enable a complex problem to be solved with acceptable accuracy.
3. Be able to describe all the terms in the Navier-Stokes equation and know what assumptions enable simplification of terms that lead to an analytical solution.
4. Be able to identify when a problem should not be reduced based on simplifying assumptions and a numerical approximation is needed.
5. Understand the fundamentals of computational fluid dynamics (CFD) including discretization, meshing, numerical solving, coupling, and boundary conditions.

6. Be able to evaluate the quality of a mesh and be able to check a solution with respect to fulfilling the continuity assumption and identify where the gradient may lead to inaccuracies.

Required Materials

Textbook

The following textbook is available for free online at www.efluids.com.

A Physical Introduction to Fluid Mechanics: Second Edition, by Alexander J. Smits, Princeton University (click on Part I: Main Text)

Additional papers and online videos will be provided on the course site in Blackboard.

Computer Lab

The computer lab in room 438 in the O'Connell Engineering Building is accessible remotely through this link, <https://itss-labmap.csuchico.edu/>.

Instructions on how to use the remote desktop can be found through ITSS at the following link, <https://support.csuchico.edu/TDClient/1984/Portal/KB/ArticleDet?ID=112192>.

Course Usage of Blackboard Learn

Blackboard will be used extensively throughout this course and announcements and emails will be sent to the entire class through Blackboard. Students are responsible for knowing and checking regularly the email account associated with their Chico State portal.

Classroom Protocol

Learning Environment

This is an upper division engineering course, and I have high expectations of all students. Come to class prepared and ready to engage in discussion and exploration in various topics most of which will be about engineering.

I want to help all students develop into outstanding, productive engineers where one's sense of curiosity is supported and celebrated. My teaching style is casual and informal. I want my classroom to be dynamic, contributory, inquisitive, and fun.

Upon graduation and as a professional, you will be asked to solve problems for which there will be no known answer. This is okay, and in fact, it is part of the definition of engineering, i.e. to solve problems. I want you to readily embrace the challenges of being an engineer and to broaden your perspective and contribute to the solution of some of the many difficult problems that face our society and planet.

Respect

Students in this class are encouraged to speak up and participate during class meetings. Because the class will represent a diversity of individual beliefs, backgrounds, and experiences, every member of this class must show respect for every other member of this class. (Reference: <http://www.csuchico.edu/diversity/>)

Safe Zone Statement

I am part of the Safe Zone Ally community network of trained Chico State faculty/staff/students who are available to listen and support you in a safe and confidential manner. As a Safe Zone Ally, I can help you connect with resources on campus to address problems you may face that interfere with your academic and social success on campus as it relates to issues surrounding sexual orientation/gender identity. My goal is to help you be successful and to maintain a safe and equitable campus.

LGBTQ Equality Statement

I am firmly committed to diversity and equality in all areas of campus life, including specifically members of the LGBTQ community. In this class I will work to promote an anti-discriminatory environment where everyone feels safe and welcome. I recognize that discrimination can be direct or indirect and take place at both institutional and personal levels. I believe that such discrimination is unacceptable and I am committed to providing equality of opportunity for all by eliminating any and all discrimination, harassment, bullying, or victimization. The success of this policy relies on the support and understanding of everyone in this class. We all have a responsibility not to be offensive to each other, or to participate in, or condone harassment or discrimination of any kind.

Attendance and In-Class Activities

Attendance and In-class activities are extremely important to learning. Attendance will be monitored using Zoom. A record of all students connecting to the class through Zoom is provided to me after each class meeting. This will be used to assign participation points which are 5% of a students' course grade.

NO MAKE-UP IS AVAILABLE FOR IN-CLASS (SYNCHRONOUS) ACTIVITIES.

Assignment Policy

Homework

Homework is a very important part of learning as it is the practice that is necessary in building knowledge. Assignments will be due approximately every week. Check the schedule in Blackboard for weekly assignment and due dates. Check regularly as dates may change.

All assignments that require a numerical solution will follow an organized problem solving process that use headings similar to the following:

- Given/Situation
- Find/Goal
- Assumptions/Generate Ideas
- Solution
- Review

The review step is an opportunity to engage in metacognitive processes. Metacognition is when we think about thinking. This can be reflecting on what was learned, how it fits into the framework of existing knowledge, or how it extrapolates into new knowledge.

Reflecting on the problem that was solved to evaluate its correctness and reflecting on the process that was followed to arrive at the solution are important metacognitive processes

that deepen our understanding and learning. The final step in solving a problem must include a review step where the solution is evaluated for accuracy and/or the process is reviewed for its appropriate use and assumptions. Review for accuracy could include checking that units were carried throughout and produce the expected result, or using the solution to compare against a known similar result, or back solving for a variable that was known in the beginning but is made unknown to see if the solution will predict its value. Reviewing the solution can also include a qualitative assessment, for example, make an educated guess of the order of magnitude of the answer and compare with the solution. Is the answer expected to be in meters but the solution that was calculated was found to be in kilometers? If so, something is likely incorrect. Recheck the process.

Homework assignments will be returned with a zero grade if they are disorganized, illegible, sloppy, missing parts, or late. The total points available for each homework assignment is based on completing all problems assigned. The total points available for partially completed assignments is prorated based on the number of problems attempted.

LATE ASSIGNMENTS ARE ACCEPTED ONLY WITH AN APPROVED AND COMPLETED LATE ASSIGNMENT POLICY AGREEMENT. See Appendix A.

Exams

Some quizzes and exams will require all students to participate remotely and at the same time using a webcam or video camera that is turned on and recording. All students will be asked to accept being recorded during these exams. If students do not consent to being recorded, they must make arrangements with the professor before the exam or quiz date and time.

Grading Policy

CSUC Definition of Grading Symbols

A - Superior work; a level of achievement so outstanding that it is normally attained by relatively few students.

B - Very good work; a high level of achievement clearly better than adequate competence in the subject matter/skill, but not as good as the unusual, superior achievement of students earning an A.

C - Adequate work; a level of achievement indicating adequate competence in the subject matter/skill. This level or higher will usually be met by a majority of students in the class.

D - Minimally acceptable work; a level of achievement which meets the minimum requirements of the course.

F - Unacceptable work; a level of achievement that fails to meet the minimum requirements of the course. Not passing.

Grading

A	100 to 93.33%	B-	83.32 to 80%	D+	69.90 to 66.67%
A-	93.32 to 90%	C+	79.90 to 76.67%	D	66.66 To 60.0%
B+	89.90 to 86.67%	C	76.66 to 73.33%	F	< 60%
B	86.65 to 83.33%	C-	73.32 to 70%		

Grade Weighting

Category	Weight
Homework	25%
Analysis Project	25%
Exams (3 midterms – 10% each, 1 final – 20%)	50%
TOTAL	100.00%

Grade Disputes

Final grades are non-negotiable. If you think a grading error has been made for any graded assignment throughout the term, you must bring this to my attention within two weeks of the date the grade was posted. Grade disputes brought up after final grades are posted will not be considered.

Cheating

Engineering is an honorable profession. Cheating is not honorable. Don't be a cheater. Anyone caught cheating on the exam or on any assignment will receive an automatic F for the course, a report will be submitted to Student Judicial Affairs, and retaking the course for forgiveness will not be possible.

University Policies and Campus Resources

COVID-19 Face Mask Requirement

In compliance with the [California Department of Public Health](#) state mandate, Chico State requires that all students, staff, and faculty, wear a face covering in all indoor spaces on campus, including classrooms, labs, studios, and offices, and outside when physical distancing is not possible. Accordingly, all students are required to wear a face mask covering the nose and mouth in order to participate in this course. Failure to comply with this requirement will result in a referral to Student Conduct, Rights, and Responsibilities and disciplinary action being taken against you by the University.

Individuals unable to wear a face covering due to a medical condition should contact the [Accessibility Resource Center](#) by phone at (530) 898-5959 or by email at arcdept@csuchico.edu.

For more information about the state mandate, please visit the [Chico State COVID-19 News & Information](#) page.

Dropping and Adding

You are responsible for understanding the policies and procedures about add/drops, academic renewal, etc. found <http://www.csuchico.edu/catalog/>. You should be aware of the new deadlines and penalties for adding and dropping classes.

Academic integrity

Students are expected to be familiar with the University's Academic Integrity Policy. Your own commitment to learning, as evidenced by your enrollment at California State University, Chico, and the University's Academic Integrity Policy requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the Office of Student Judicial Affairs. The policy on academic integrity and other resources related to student conduct can be found on the Student Judicial Affairs web site, <http://www.csuchico.edu/sjd/>.

IT Support Services

Computer labs for student use are located on the first and fourth floor of the Meriam Library, Room 116 and 450, Tehama Hall Room 131, and the Bell Memorial Union (BMU) basement. You can get help using your computer from IT Support Services; contact them through their website, <http://www.csuchico.edu/its>. Additional labs may be available to students in your department or college.

Student Services

Student services are designed to assist students in the development of their full academic potential and to motivate them to become self-directed learners. Students can find support for services such as skills assessment, individual or group tutorials, subject advising, learning assistance, summer academic preparation and basic skills development. Student services information can be found at: <http://www.csuchico.edu/current-students>.

Americans with Disabilities Act

If you need course adaptations or accommodations because of a disability or chronic illness, 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. Please also contact Accessibility Resource Center (ARC) as they are the designated department responsible for approving and coordinating reasonable accommodations and services for students with disabilities. ARC will help you understand your rights and responsibilities under the Americans with Disabilities Act and provide you further assistance with requesting and arranging accommodations.

Accessibility Resource Center

<http://www.csuchico.edu/arc>

530-898-5959

Student Services Center 170

arcdept@csuchico.edu

Student Learning Center

The mission of the Student Learning Center (SLC) is to provide services that will assist CSU, Chico students to become independent learners. The SLC prepares and supports students in their college course work by offering a variety of programs and resources to meet student needs. The SLC facilitates the academic transition and retention of students from high schools and community colleges by providing study strategy information, content subject tutoring, and supplemental instruction. The SLC is online at <http://www.csuchico.edu/slc>. The University Writing Center has been combined with the Student Learning Center.

Late Assignment Policy

[Follow this link for a copy of the Late Assignment Policy](#)