

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

MECH 435, Low Speed Aerodynamics, Section 01, Spring 2018

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|------------------------------|---|
| Instructor: | Assistant Professor David G. Alexander |
| Office location: | O'Connell (OCNL) 422 |
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| Office hours: | Wednesdays 9:00 AM – 11:00 AM Thursdays 2:30PM – 4:30 PM or by appointment |
| Class days and times: | Lecture: TuTh 9:30AM – 10:45AM |
| Classroom: | Lecture: OConnell (OCNL) 124 |
| Prerequisites: | MATH 260 (Differential Equations) and CIVL 321 (Fluids) |

Overview

Low speed aerodynamics is one of several technical electives offered to mechanical engineering majors. As a technical elective, the subject matter is intended for junior and senior level students. This course will focus on several key areas including fundamentals of fluid mechanics/dynamics, dimensional analysis, similarity solutions, flow over airfoils, wind turbine performance and design, ground vehicle aerodynamics, and basic computational fluid dynamics.

How to Succeed in this Class

To be successful in college one should understand what learning is. Learning is the process of creating new connections in the brain. This is normal. Building these connections takes time and effort. This is normal. 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 the 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/Yn966v5INaI?list=PL4111402B45D10AFC>.

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. 3 hours discussion.

Course Goals

Develop skills and understanding to confidently solve complex fluid dynamics problems. Create a framework for researching, analyzing and presenting complex information to peers. Contribute to the authoring of an online textbook in low speed aerodynamics.

Student Learning Outcomes

1. Be able to solve static and dynamic fluid flow problems using Euler's equation and Bernoulli's equation.
2. Be able to identify and describe the terms in the Navier-Stokes equation.
3. Solve Poiseuille and Couette flow problems using Navier-Stokes equation.
4. Be able to describe the boundary layer and its significance in viscous flow.
5. Be able to solve for the coefficient of drag, lift, thrust, and performance of an airfoil.
6. Use inviscid flow to describe characteristic behavior in fluid flow.
7. Be able to effectively research a topic or concept and write a summary about one's findings.
8. Be able to write effectively and explain fluid concepts.

Required Materials

Textbook

There is no textbook required for this class. The topics covered will be based on several different resources and references. You will be responsible to conduct research and bring to class relevant material from reference material and share it

with the class. Libraries, internet searches, journal publications, magazines, articles, and interviews will be your textbooks.

Equipment

We may have opportunities to use the wind tunnel in Langdon 122 in small groups to test and observe fluid dynamic phenomenon.

Course Usage of Blackboard Learn

Copies of the course syllabus and major assignments are found on Blackboard Learn. You are responsible for regularly checking the online resources, which is accessed through the Chico State Portal at <http://portal.csuchico.edu>.

Some assignments will be administered online through Blackboard Learn. Deadlines for the last date and time to take and submit the assignment will be provided in Blackboard Learn. Once the deadline is reached the assignment will no longer be available. All assignment grades are final after the deadline.

Blackboard will be used to send announcements and emails to the entire class on occasion. 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.

Attendance and In-Class Activities

Attendance and In-class activities are extremely important to learning. Attendance will be monitored by collecting in-class activities in and recording assignments not picked up when returned. Assignments and exams will be returned in class only once. At the end of the semester, students will receive one absence for each assignment including homework, in-class activities, and exams that were not picked up when originally returned in class. The participation grade will be reduced two percentage points for each absence. NO MAKE-UP IS AVAILABLE FOR IN-CLASS ACTIVITIES.

Assignment Policy

Homework

See the course rubric for additional help on how assignments will be evaluated and graded. The rubric is provided on the course Bblearn site. All assignments will be returned with a zero grade if there is no organization, they are not legible, portions are missing or they are late.

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

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

See the course rubric for additional help on how assignments will be evaluated and graded. The rubric is provided on the course Bblearn site or Appendix below.

Homework assignments will be returned with a zero grade if they are disorganized, illegible, 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 B or Bblearn.

Blackboard Wiki

We will be creating an online textbook by using the Blackboard Wiki feature. Students in groups of three will create content and post the content in a wiki. Topics will be assigned based on input from the class and agreed upon structure for the online textbook. Each post will include an engineering example. Each individual is responsible for submitting their contribution to the wiki through their individual Blackboard account.

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 | 93.3% to 100.0% | B- | 73.3% to 76.7% | D+ | 60.0% to 63.3% |
| A- | 86.7% to 93.3% | C+ | 70.0% to 73.3% | D | 56.7% to 60.0% |
| B+ | 80.0% to 86.7% | C | 66.7% to 70.0% | F | 53.3% to 0% |
| B | 76.7% to 80.0% | C- | 63.3% to 66.7% | | |

Grade Weighting

| Category | Weight |
|------------------|----------------|
| Homework/Project | 10% |
| Midterm Exam | 20% |
| Final Exam | 30% |
| Wiki | 40% |
| 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

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/itss>. 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.

Appendix A – Rubric

| Score \ Area | 1 Beginner | 2 Novice | 3 Intermediate | 4 Advanced | 5 Professional |
|--|---|---|--|---|--|
| Demonstrated Technical competency | Many math errors, no units | Frequent math errors, seldom uses units and does not check for unit consistency | Few math errors, inconsistent use of units and some checks for consistency | 0 or 1 math errors, applies units most of the time and checks for consistency | No math errors, carries units throughout and checks for consistency |
| Demonstrated application of scientific and engineering principles | Does not apply principles correctly | Mostly does not apply principles correctly | Applies principles inconsistently | Mostly applies principles correctly | Applies principles correctly and to areas outside assignment |
| Organization and clarity | No organization, unclear what or where the solution is | Little organization and incorrect process or explanation of solution process, answer is not clearly identified or if identified not clear how it was determined | Some organization but does not emphasize process with clear, meaningful content at each step. Answer is identified but sometimes unclear how it was determined | Mostly organized with statements at each step explaining solution process; answer is clearly identified | Clear organization including identification of problem statement, goal, solution, and review; neat orderly; answer is clearly marked, identified and discussed |
| Written communication | Illegible and confusing, misspelled words and incorrect grammar and punctuation | Mostly incomplete sentences with no paragraph structure and misspellings | Mostly complete sentences but paragraph and sentence structure is awkward and difficult to follow. | Complete sentences and some paragraph organization but sometimes difficult to follow | Writes in complete sentences, uses clear opening sentences in paragraphs, and organizes subjects comprehensibly and clearly |
| Review | Provides no review or justification for results | Little review, justifies with, “seems right”, “looks good”, “seems reasonable”, or etc. | Some review of answer and supports with data or logic/reason, Sometimes justifies results with “seems right”, “looks good”, etc. | Provides a review and supports results with data or logic/reason | Provides a clear and succinct review to the solution, results justified by data and/or logic/reason and/or basic principles |

Appendix B

Late Assignment Policy Agreement

The following policy and agreement pertains to all assignments, which includes submitted artifacts, e.g. homework, reports, or exams, or attendance in class or outside of class that are assessed and become the bases for receiving credit toward a course grade.

Assignments are not accepted for credit if submitted after their due date and time. Exams are not accepted for credit if rescheduled after the date and time that they are administered in class.

If assignments are not turned in on or before their due date or a student is absent from class (lecture or laboratory), then the following conditions will determine whether or not and how much credit will be given for the assignment or attendance. This agreement is non-negotiable and must be completed by each student requesting credit for any late assignment, exam or absence. If this agreement and supporting documentation is not provided, there will be no credit given, and there will be no discussion about the particular circumstances that resulted in the late assignment.

1. Was the student involved in an accident, admitted to the hospital or seen by a medical professional on or within 24 hours of the assignment or exam due date?

Yes

No

2. Is it 48 hours in advance of the exam or homework due date?

Yes

No

3. Is the need to reschedule an assignment or exam due to a job interview, work schedule conflict, family emergency, childcare issue, or other related circumstance?

Yes

No

If you answered Yes to question (1) or Yes to both questions (2) and (3), your situation will be considered for appropriate accommodations.

Provide documented evidence, e.g. physician's note, admission to a medical facility for care, or other evidence of accident, event, or circumstance, that includes the date and time of services or event and submit with this signed agreement to instructor.

For which assignment are you seeking credit: _____

If you did not answer Yes to question (1) or Yes to both questions (2) and (3), you will not receive credit for the late or missed assignment or exam. Do not turn in this agreement.

Name:

Signature:
