

AME 460 Aerodynamic Theory

University of Southern California – Spring 2018

Course Syllabus

Term	Spring 2018 (Jan. 8 – May 9, 2018)
Lectures	Tuesdays and Thursdays, 9:30–10:50am, in VHE 210
Instructor	Alejandra URANGA ▪ Email: auranga@usc.edu <u>Office Hours</u> : Tue. and Thurs. 11am-12pm in RRB 218
Teaching Assistant	Tianbo (Raye) XIE ▪ Email: tianboxi@usc.edu <u>Office Hours</u> : Mon. 10-11am; Wed. 12-1pm; Fri. 2-3pm in VHE 202

Course Description

The goal of the course is to teach the fundamental concepts and techniques used in aerodynamics—the study of the flow of air about a body—as applied to subsonic, transonic, and supersonic regimes. Topics covered include conservation principles, incompressible flows, potential flows, thin airfoil and lifting line theories, quasi-one-dimensional compressible flows and shocks, small disturbance approximation, and an introduction to boundary layer theory.

Textbook John D. Anderson Jr., *Fundamentals of Aerodynamics*, 6th edition, 2016, McGraw-Hill

Required Preparation

- AME 309 Dynamics of Fluids, or equivalent course in fluid mechanics
- Basic physics, vector calculus, and differential equations, at a level common to 1st year college

Grading

- Homework: 30% of final grade (two lowest grades dropped)
- Exam 1: 35% of final grade (in-class and take-home parts equally weighted)
- Exam 2: 35% of final grade (in-class and take-home parts equally weighted)

Resources

Blackboard course management system <https://blackboard.usc.edu>

Course material will be posted on **Blackboard**. This includes homework assignments, but graded homework and exams will only be available on **gradescope** (see below).

Piazza Discussion Forum https://piazza.com/usc/spring2018/20181_ame460/home

You are strongly encouraged to use the **Piazza discussion forum** (integrated within Blackboard) to ask questions, make comments, and answer questions from your peers. When discussing homework assignments, do not give out the answers to questions! That would be a violation of the Collaboration Policy. Public posts related to graded assignments should only be for clarification purposes. No posts are allowed while a take-home exam is out.

Homework and Exam Grading on gradescope <https://gradescope.com>

Assignments will be graded on **gradescope**. You will submit your homeworks and exams on paper, and see your grade and comments online on gradescope once they are graded.

You will receive an email to your USC email address with instructions on how to log in after the first homework is graded.

References

The following references might be a good complement for those students who want to get another perspective or go in more depth on the material.

Fundamentals:

- J. Katz and A. Plotkin *Low-Speed Aerodynamics*, Cambridge University Press
- J.D. McLean, *Understanding Aerodynamics*, John Wiley and Sons

Advanced Topics:

- M. Drela, *Flight Vehicle Aerodynamics*, 2014, MIT Press
- F.M. White, *Viscous Fluid Flow*, McGraw-Hill
- H. Schlichting, *Boundary Layer Theory*, Springer

Course Policies

These course policies are designed to help students learn the material effectively, and the course assessment system is designed to best test students on what they really know, and can effectively use, in a real-world context. To ensure fairness, the rules will be strictly enforced.

Collaboration

- Collaboration of any sort on all matters that are not graded is strongly encouraged.
- Students may discuss the homework problems with one another, but no written or digital material can be part of such exchanges. *If it's not in your head, it isn't yours.* The corollary is that *you must develop and write your own solutions.*
- *Absolutely no collaboration is allowed on take-home exams:* these are individual efforts, and you are not allowed to discuss them with anyone else than the instructor.
- We will be very strict about academic integrity violations and report them as appropriate.

Homework Assignments

- Weekly homework will be assigned on Thursdays and due the following Thursday most weeks (except before exams). It is due *before* class begins on the due date. To be fair to everyone, late submissions will incur a 20% penalty after the due *time* (9:30am) and for each 24h delay.
- Homework must be submitted in class to the instructor on paper on the assignment pages provided (hard-copies). If you are not able to make the lecture on a due date, email your submission to the instructor by the due time.
- The two lowest homework grades will be dropped when computing the homework portion of the final grade.
- In order to receive full credit, solutions must be presented in a clear manner, and show evidence of work: magical one-line answers do not make the cut. The reasoning is as important as the solution. *This also applies to the exams.*

Office Hours

Office hours are held by both instructor and teaching assistant, and provide a good opportunity for you to get clarifications and better understand the course material. This time is best utilized when students come with *clear questions* and at least *an attempt at a solution*. The goal is for us to help you clarify the concepts and guide you through your thought process. *It is not meant as a way for you to effortlessly obtain the solutions.* So come often but prepared.

Topics and Tentative Schedule

You are responsible for reading the chapter(s) in the textbook before the corresponding lecture.

Week	Date	Topics	Reading
1	JAN 9, 11	I. Introduction	
2	JAN 16, 18	II. Conservation laws Conservation laws (cont.)	Ch. 2
3	JAN 23, 25	III. Incompressible potential flows . Flow modeling	Ch. 3, 6
4	JAN 30, FEB 1	. Non-lifting and lifting flow models	
5	FEB 6, 8	. 2D aero models	Ch. 4
6	FEB 13, 15	. 2D aero models (cont.)	
7	FEB 20, 22	. 3D aero models	Ch. 5
8	FEB 27 MAR 1	Exam 1: Tuesday February 27 VI. Shock-expansion theory . Gas dynamics, energy equation	Ch. 7
9	MAR 6, 8	Exam 1 take-home part due: Tuesday Mar. 6 VI. Shock-expansion theory (cont.) . Normal shocks, oblique shocks . Expansion waves, nozzles	Ch. 8, 9 Ch. 10
10	MAR 13, 15	<i>No class: Spring Break</i>	
11	MAR 20, 22	V. Inviscid compressible aero . Small disturbances . Subsonic linearized potential flow, Prandtl-Glauert	Ch. 11, 12
12	MAR 27, 29	. Supersonic linearized potential flow	
13	APR 3 APR 5	. Transonic flows Exam 2: Thursday April 5	
14	APR 10, 12	VI. Viscous flows and boundary layer theory . Viscous flows fundamentals . Boundary layer equations	Ch. 15 Ch. 17
15	APR 17, 19	Exam 2 take-home part due: Thursday Apr. 12 . Laminar boundary layers . Turbulent boundary layers	Ch. 18 Ch. 19
16	APR 24, 26	. Stability and transition	

Statement on Academic Conduct and Support Systems

Academic Conduct

Plagiarism—presenting someone else’s ideas as your own, either verbatim or recast in your own words—is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, “Behavior Violating University Standards” <https://policy.usc.edu/scampus-part-b/>. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct>.

Support Systems

Student Counseling Services (SCS) - (213) 740-7711 24/7 on call

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention. <https://engemannshc.usc.edu/counseling/>

National Suicide Prevention Lifeline – 1-800-273-8255

Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. <http://www.suicidepreventionlifeline.org>

Relationship & Sexual Violence Prevention Services (RSVP) – (213) 740-4900 - 24/7 on call

Free and confidential therapy services, workshops, and training for situations related to gender-based harm. <https://engemannshc.usc.edu/rsvp/>

Sexual Assault Resource Center

For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: <http://sarc.usc.edu/>

Office of Equity and Diversity (OED)/Title IX compliance – (213) 740-5086

Works with faculty, staff, visitors, applicants, and students around issues of protected class. <https://equity.usc.edu/>

Bias Assessment Response and Support

Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. <https://studentaffairs.usc.edu/bias-assessment-response-support/>

Student Support & Advocacy – (213) 821-4710

Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. <https://studentaffairs.usc.edu/ssa/>

Diversity at USC

Tab for Events, Programs and Training, Task Force (including representatives for each school), Chronology, Participate, Resources for Students <https://diversity.usc.edu/>