THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Aerospace Engineering and Engineering Mechanics

ASE 320 Low Speed Aerodynamics
Summer 2020

SYLLABUS

Unique Number:	74639
Instructor:	Dr. Raghav Mahalingam raghavmahalingam@austin.utexas.edu
Lecture Time:	M through F 11.30am-1pm
Location:	Zoom, Link available via Canvas Calender
Office Hours:	By appointment
Teaching Assistants:	None
Web Page:	Canvas (canvas.utexas.edu)
Text:	Fundamentals of Aerodynamics, 6th edition John D. Anderson, McGraw Hill
Additional References:	Fluid Mechanics, 6th Edition, Frank M. White, McGraw-Hill, 2003 Introduction to Fluid Mechanics, 4th or later edition, Robert Fox, Alan McDonald and Philip Pritchard, Wiley.
Catalog Description:	Fundamental concepts, fluid statics; integral and differential analysis; detailed analysis of inviscid, incompressible flows; aerodynamics of airfoils and wings. Three lecture hours a week for one semester.
Course Objectives:	To develop student knowledge of fluid properties, fluid statics, integral and differential analysis of fluid flow problems, detailed analysis of inviscid incompressible flow, aerodynamics of wings and airfoils.
Prerequisites:	Mathematics 427L and Mechanical Engineering 310T with a grade of at least C- in each.
Computer:	Homework problems might require the use of computer software tools and simple programming. You are expected to know how to use a computer.

Important dates:

Fri, June 19th	Test 1, Via Canvas
Fri, Jul 3rd	Test 2, Via Canvas
TBD, July 10/11	Final Exam, Via Canvas

Note: No alternate date for the final. Check final exam schedule and location. If you have 3 finals on the same day, start preparing NOW.

Grading:

Homework: 15%
Two In-Class tests: 50% (25% each)
Final Exam: 35%

Letter grades will be assigned as follows:

Score	95-100	90-95	85-89	80-84	75-79	70-74	65-69	60-64	50-59	<50
Grade	A	A-	B+	B	B-	C+	C	C-	D	F

Knowledge, Skills, and Abilities Students Should Have Before Entering This Course:
Mathematics of calculus and differential equations and background in physics.

Knowledge, Skills, and Abilities Students Gain from this Course (Learning Outcomes):
Physical understanding of the various physical phenomena that can occur in fluid flow.
Basic tools of analysis of fluid mechanics: conservation of mass, momentum and energy and equations of state. An understanding of the analysis of simple inviscid, incompressible flows and the application of these to the flow over airfoils and finite wings.

Impact On Subsequent Courses In Curriculum:
The basic tools of fluid mechanics and the extensive applications to inviscid incompressible flows, including airfoils and wings, serve as a foundation for subsequent courses in compressible fluid mechanics (ASE 362K), applied aerodynamics (ASE 364), and propulsion (ASE 376K).

Relationship of Course to Program Outcomes:
This course contributes to the following ABET Criterion 3 outcomes and those specific to the EAC accredited program.

Outcome	√	**Outcome**	√
a. An ability to apply knowledge of mathematics, science, and engineering	√	g. An ability to communicate effectively	√
b. An ability to design and conduct experiments, as well as to analyze and interpret data		h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.	
c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.		i. A recognition of the need for and an ability to engage in life-long learning	
d. An ability to function on multi-disciplinary teams		j. A knowledge of contemporary issues	
e. An ability to identify, formulate, and solve engineering problems	√	k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	√
f. An understanding of professional and ethical responsibility			

ABET Program Criteria Achieved:
Program criteria are unique to each degree program and are to be compiled from the program criteria given for each degree program and listed in table format below.

Criterion	√	**Criterion**	√	**Criterion**	√
A. Aerodynamics	√	G. Orbital Mechanics		M. Preliminary/Conceptual Design	
B. Aerospace Materials		H. Space Environment		N. Other Design Content	
C. Structures		I. Attitude Determination and Control		O. Professionalism	
D. Propulsion	√	J. Telecommunications		P. Computer Usage	
E. Flight Mechanics	√	K. Space Structures			
F. Stability and Control		L. Rocket Propulsion	√		

Topics (#lectures):28

1. Introduction (1)
2. Fundamental Concepts, Aerodynamic forces, moments and coefficients, Dimensional Analysis (3)
3. Fluid Statics and Dynamics (2)
4. Methods of flow description, Control Volumes, Integral Relations (4)
5. Differential Analysis, continuity, Navier-Stokes (5)
6. Incompressible Inviscid Flow, Euler equations, Bernoulli's equation (1)
7. Flow About Immersed Bodies, Drag, Lift (5)
8. Review lectures (3)
9. In-Class Tests (2)

Professionalism Topics: none

Design Assignments: none

Laboratory Assignments: None

Class Format:
This is a lecture class. It will help you to read the relevant chapters **before** the lectures. Do not schedule job interviews, plan trips, etc. which conflict with test dates. The final exam will be comprehensive.

Class Outline:
See lecture outline at the end of this syllabus

Homework Policy:
Homework is essential to help you master the material. Typically 2-4 homework problems will be assigned every week. There are a total of 9 regular homework assignments through the course and 1 advisement appointment (HWX) for a total of 10 points. They are generally due at the start of class on the day listed in this document. ***Homework solutions will be submitted on Canvas***. There will be no paper submissions. Solutions to the homework will be posted electronically after the submission date and no homework will be accepted after it is posted unless you have obtained prior permission. You are welcome to discuss the homework problems and solution strategies with your classmates but solve the problems yourself. Copying homework from a Legacy folder or from another student and presenting it as your own work is a violation of professional ethics.

Examinations:
Two in-class tests and a final comprehensive exam. All exams will be closed book. Information handouts (equations, data etc.) will be provided with the exam if needed.

Attendance:
Your grades are determined by your performance on tests and homework. I strongly encourage you to attend class and I will not tutor you in my office on topics that were discussed in classes

you did not attend. Homework must be turned in on time to receive credit and you must attend all tests unless you have a relevant documented reason for being absent.

Please do not schedule job interviews, plant trips, etc. which conflict with test dates. If a test conflicts with a religious holiday that you observe, please notify me in advance so I can arrange an alternate test date for you. The same rules apply to homework submission. If you are sick for an exam please notify me beforehand via e-mail. A medical certificate is required for an excused absence and a make-up test.

Evaluation:
UT Course-Instructor survey at the end of the semester. Feedback on my teaching is welcome at any time. Tell me in person or send me a note. What you tell me early will benefit this class. Feedback at the end of the semester benefits the next class.

Other Administrative Matters:
1) Students who violate University rules on scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and/or dismissal from the University. Since such dishonesty harms the individual, all students, and the integrity of the University, policies on academic dishonesty will be strictly enforced. For further information please visit the Student Judicial Services web site: http://deanofstudents.utexas.edu/sjs/

2) An engineering student must have the Dean's approval to add or drop a course after the fourth class day of the term. Adds or drops are not approved after this except for good cause. "Good cause" is interpreted to be documented evidence of an extenuating nonacademic circumstance (such as health or personal problems) that did not exist on or before the fourth class day. Applications for approval to drop a course after the fourth class day should be made in the Office of Student Affairs, ECJ 2.200.

3) Web-based, password-protected class sites are available for all accredited courses taught at The University. Syllabi, handouts, assignments and other resources are types of information that may be available within these sites. Site activities could include exchanging e-mail, engaging in class discussions and chats, and exchanging files. In addition, class e-mail rosters will be a component of the sites. Students who do not want their names included in these electronic class rosters must restrict their directory information in the Office of the Registrar, Main Building, Room 1. For information on restricting directory information see:
http://registrar.utexas.edu/students/records/restrictmyinfo

Course documents will be posted on Canvas

4) All students should become familiar with the University's official e-mail student notification policy. It is the student's responsibility to keep the University informed as to changes in his or her e-mail address. Students are expected to check e-mail on a frequent and regular basis in order to stay current with University-related communications, recognizing that certain communications may be time-critical. It is recommended that e-mail be checked daily, but at a minimum, twice per week. The complete text of this policy and instructions for updating your e-mail address are available at http://www.utexas.edu/its/policies/emailnotify.html. In this course e-mail will be used as a means of communication with students. You will be responsible for checking your e-mail regularly for class work and announcements.

5) The University of Texas at Austin provides, upon request, appropriate academic adjustments for qualified students with disabilities. Any student with a documented disability (physical or cognitive) who requires academic accommodations should contact the Division of Diversity and Community Engagement, Services for Students with Disabilities, 471-6259.
http://www.utexas.edu/diversity/ddce/ssd

6) By UT Austin policy, you must **notify me of your pending absence at least fourteen days prior to the date of observance of a religious holy day**. If you must miss a class, an examination, a work assignment, or a project in order to observe a religious holy day, you will be given an opportunity to complete the missed work within a reasonable time after the absence.

ASE 320 Expected Course Outline

Date	Day	Lecture #	Topic	Tests	Reading
4-Jun	Thu	1	Course Overview: Review Syllabus, Introduction		
5-Jun	Fri	2	Basics of fluids, fluid properties and fields		Chap 1
8-Jun	Mon	3	Dimensional Analysis, Buckingham Pi theorem		Chap 1
9-Jun	Tue	4	Aerodynamics Forces and Moments, Coefficients		Chap 1
10-Jun	Wed	5	Fluid Statics		Chap 1
11-Jun	Thu	6	Fluid Dynamics: Types of Flow		Chap 1
12-Jun	Fri	7	Calculus Review, 1D-2D-3D, Streamlines etc		Chap 2
15-Jun	Mon	8	Control Volumes and Reynolds Transport Theorem		Chap 2
16-Jun	Tue	9	Conservation of Mass, Momentum and Energy		Chap 2
17-Jun	Wed	10	Conservation of Mass, Momentum and Energy		Chap 2
18-Jun	Thu	11	Review for Test1		Chap 2
19-Jun	Fri	12	In Class Test 1	Test 1	
22-Jun	Mon	13	Differential Analysis, continuity equation		Chap 2
23-Jun	Tue	14	Velocity Potential, Irrotational Flow		Chap 2
24-Jun	Wed	15	Stream Function, Simple fluid structures		Chap 2
25-Jun	Thu	16	Fluid Rotation, Circulation, Vorticity, fluid deformation		Chap 2
26-Jun	Fri	17	Derivation of Navier Stokes equations, similarity parameters		Chap 3
29-Jun	Mon	18	Inviscid, Incompressible Flow Intro, Euler Equation, Bernoulli equation		Chap 3
30-Jun	Tue	19	Flow over a circular cylinder		Chap 3
1-Jul	Wed	20	Magnus effect, Lift flows over a cylinder, Kutta Joukowski Theorem		Chap 3
2-Jul	Thu	21	Review for Test2		
3-Jul	Fri	22	In Class Test 2	Test 2	
6-Jul	Mon	23	Kutta condition, Kelvins' Theorem, Classical Thin Airfoil Theory		Chap 4
7-Jul	Tue	24	Finite Wing Analysis Downwash, induced drag		Chap 5
8-Jul	Wed	25	Lifting Line Theory, Finite Wing Considerations		Chap 5
9-Jul	Thu	26	Review for Final		
10/11Jul				Final	Comprehensive

Prepared by: Raghav Mahalingam Date: 5/21/20