

**THE UNIVERSITY OF TEXAS AT AUSTIN**

**ASE 379L AIRFOIL AND WING THEORY  
Spring 2007**

**SYLLABUS**

**UNIQUE NUMBER:** 13010

**INSTRUCTOR:** Dr. K. Bulent Yuceil  
WRW 302C, 471-3023, 471-6085 (PRC Lab), yuceil@mail.utexas.edu

**TIME:** TTh 12:30 – 2:00 p.m.

**PLACE:** CPE 2.204

**TEACHING ASST.:** Shankar Mahadevan,  
WRW 216, 471-1492, shankarmahadevan@mail.utexas.edu

**WEB PAGE:** Log into *Blackboard* at <http://courses.utexas.edu/>

**OBJECTIVES:**

The objective is to give aerospace engineering students a firm understanding of airfoil and wing theory, the assumptions behind it, and the resulting limitations and applications. We will start with the incompressible flows around airfoils and wings and extend it to transonic and supersonic cases. The course will be a balance between the theory and applications.

**PREREQUISITES:**

ASE 362K (Compressible Fluid Mechanics) or registration for ASE 362K

**KNOWLEDGE, SKILLS, AND ABILITIES STUDENTS SHOULD HAVE BEFORE ENTERING THIS COURSE:**

Students should have had an introductory course dealing with the fundamentals of fluid mechanics and the dynamics of an incompressible inviscid flow field such as fluid properties, the standard atmosphere, conservation laws, similarity parameters, concept of boundary layer, Bernoulli equation, pressure coefficient, circulation, irrotational flow, Kelvin's theorem, stream function, elementary flows, flow around a cylinder, etc.

**KNOWLEDGE, SKILLS, AND ABILITIES STUDENTS GAIN FROM THIS COURSE:**

Ability to understand the general aspects of theory and applications of airfoils and wings in incompressible and compressible flows and to solve simple problems associated with the application of the theory. Gain an understanding of the application of theory to aircraft design and development in terms of choosing the proper airfoil and wing geometry and parameters for required design goals and investigating the impact of different airfoil and wing parameters on vehicle performance.

**IMPACT ON SUBSEQUENT COURSES IN CURRICULUM:**

This is a technical area elective. This course will provide students with a more aerodynamics perspective in future Aircraft Design courses.

**ABET CRITERIA 2000 OUTCOMES ACHIEVED:**

This course contributes to the following EC2000 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/societal context	
c. An ability to design a system, component, or process to meet desired needs	√	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		l. Begin list of any other outcomes unique to the program.	

**ABET PROGRAM CRITERIA OUTCOMES ACHIEVED:**

Program criteria outcomes are unique to each degree program and are to be compiled from the program criteria given for each degree program and listed in bullet 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			

**PROFESSIONALISM TOPICS:**

None.

**TOPICS:**

List the major topics in the course and in parentheses the number of classes in which the topic is covered; assume 42 classes as in a MWF class on a long-session semester for this purpose. Give also in separate parentheses the Criteria 2000 and program criteria outcome(s) addressed by each topic referenced by letter.

1. Characteristic Parameters for Airfoil and Wing Aerodynamics (4) (Criteria 2000:a,c,g,A)
2. Incompressible Flows Around Airfoils of Infinite Span (4) (a,e,g,k,A)
3. Incompressible Flow about Wings of Finite Span (8) (a,e,g,k,A)
4. Compressible, Subsonic Flows and Transonic Flows (4) (a,e,g,A)
5. Two-Dimensional, Supersonic Flows Around Thin Airfoils (2) (a,e,g,k, A)
6. Supersonic Flows Over Wings and Airplane Configurations (6) (a,c,e,g,k,A)

**DESIGN ASSIGNMENTS**

None. However, some homework questions may require making design choices.

**LABORATORY ASSIGNMENTS:**

None.

**COMPUTER:**

A computer may and can be used to solve both numerical and analytical based problems. Example tools include Matlab, Mathematica, spreadsheet applications such as MS Excel, and other general language compilers such as Basic, Fortran, C, C++, C#, Java.

**TEXT:**

Bertin, John J, *Aerodynamics for Engineers*, Forth Edition, Prentice Hall, 2002.

**CLASS FORMAT:**

This is a lecture class and meets two times a week.

**CLASS SCHEDULE:**

The schedule/outline given below is approximate and subject to change.

1. Characteristic Parameters for Airfoil and Wing Aerodynamics (2 weeks)
2. Incompressible Flows Around Airfoils of Infinite Span (2 weeks)
3. Incompressible Flow about Wings of Finite Span (4.5 weeks)
4. Compressible, Subsonic Flows and Transonic Flows (2 weeks)
5. Two-Dimensional, Supersonic Flows Around Thin Airfoils (1 week)
6. Supersonic Flows Over Wings and Airplane Configurations (2 + weeks)

**GRADING:**

The final grade is based on the following components

- |                |     |   |
|----------------|-----|---|
| 1) Homework    | 30% |   |
| 2) Quizzes (2) | 30% | In class, Approx. at 6 <sup>th</sup> and 13 <sup>th</sup> weeks |
| 4) Final exam  | 40% | 7pm-10pm, Wednesday May 9, 2007                                 |

Total 100%

Grades will be based on a curve according to overall class performance.

**HOMEWORK POLICY:**

Homework assignments will usually be given upon completion of the major topics listed above approximately every two weeks. There may be two or more assignments per major topic. Total number of homework assignments will be around 5-6. Assignments are due at the start of the class on the due date. Homework must be neat and legible to receive a grade. Late assignments will not be accepted.

**EXAMINATIONS:**

Two in-class quizzes (15% each) will be given during the semester at approximately the dates shown above. If there is any change in quiz dates a two-week notice will be given. Final exam will be comprehensive. There may be open and closed book sections in quizzes and the final exam.

**ATTENDANCE:**

Regular attendance is expected. Repeated unexcused absence from class is a justification for a downward adjustment of the student's grade. Medical and professional (e.g., job interview or planned field trip) absences are accepted. In all cases the student should notify the instructor of any planned absences before that class if at all possible.

**OFFICE HOURS:**

Tuesday and Thursday 3:00-4:00 p.m. at WRW 302C, by appointment or just drop by.  
E-mail is welcome.  
Office hours for the T.A. will be announced.

**IMPORTANT DATES:**

Last day of the official add/drop period:	Monday Feb 12, 2007
First Quiz (approx.):	Thursday February 22, 2007
Second Quiz (approx.):	Thursday April 19, 2007
Last Class Day:	Thursday May 3, 2007
Final Exam:	Wednesday May 9, 2007, 7-10 pm

See appropriate academic calendar for other important dates.

**SPECIAL NOTES:**

The University of Texas at Austin provides upon request appropriate academic adjustments for qualified students with disabilities. For more information, contact the Office of the Dean of Students at 471-6259, 471-4641 TDD or the College of Engineering Director of Students with Disabilities at 471-4321.

Web-based, password-protected class sites are associated with all academic 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, electronic class 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.

**EVALUATION:**

The Measurement and Evaluation Center forms for the College of Engineering will be used during the last week of class to evaluate the course and the instructor. Comments are welcomed at anytime either in written or verbal form. Please feel free to drop off anonymous comments or criticisms in my mailbox on the 2nd floor or under my door. These comments can be related to my class lectures, class policy, specific homework assignments or exams, or any other relevant topic.