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

ASE 355 Aeroelasticity

Spring 2013

SYLLABUS

Unique Number:	13330
Instructor:	Dr. Jayant Sirohi WRW 301D, 471-4186 jayant.sirohi@mail.utexas.edu
Time:	TuTh 12:30 – 2:00pm
Location:	WRW 312
Teaching Assistant.:	None
Web Page:	-

Catalog Description:

Flutter, divergence, control reversal, flexibility effects on aircraft stability and control; design implications; stability augmentation and response suppression; introduction to quasi-steady aerodynamic theories. Three lecture hours a week for one semester.

Course Objectives: General introduction to aeroelastic phenomena, including divergence, control reversal, flutter, and flexibility effects on stability and control; unsteady aerodynamic theories for lifting surfaces and bodies; aeroelastic model testing.

Prerequisites: ASE 321K (or 221K and 121M) and 330M, with a grade of at least C in each

Knowledge, Skills, and Abilities Students Should Have Before Entering This Course:

Students should understand the fundamental concepts from past structures and fluids courses.

Knowledge, Skills, and Abilities Students Gain from this Course (Learning Outcomes):

Students will gain an understanding of the fundamental causes of various static and dynamic aeroelastic phenomena. They will be able to analyze and predict the behavior of systems with combined structural and aerodynamic loads. They will understand the impact of aeroelastic considerations on the design of aircraft, and will be able to design suitable experimental models to test specific aeroelastic phenomena.

Impact On Subsequent Courses In Curriculum:

This course is not a prerequisite for any other undergraduate course.

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. The faculty should check which of the program criteria are achieved in the course.

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:

1. Review of tools for aerodynamic and structural analysis (12 hours) (a, e, k, A, C, P)
2. Derivation and solution of equations of motion governing systems with combined aerodynamic and structural, static and dynamic loads. Evaluation of the effect of combined aerodynamic and structural loads on aircraft design, stability and control. (21 hours) (a, e, k, A, C, E, F, P)
3. Design and analysis of dynamically scaled aeroelastic systems. (9 hours) (c, e, k, P)

Professionalism Topics:

None.

Design Assignments:

None.

Laboratory Assignments:

None.

Computer:

Use of computers for analyzing vibrating systems, including solving eigenvalue problems. Requires computer and Matlab software.

Text:

Topics will be covered from multiple textbooks

- *Aeroelasticity* by Raymond L. Bisplinghoff, Holt Ashley and Robert L. Halfman. Dover Publications, 1996, ISBN-10: 0486691896, ISBN-13: 978-0486691893
- "*An Introduction to the Theory of Aeroelasticity*" by Y. C. Fung. Dover Publications, 2008, ISBN-10: 0486469360, ISBN-13: 978-0486469362

Class Format:

This is a lecture class that meets twice a week.

Class Outline/ Schedule:

The schedule given below is approximate. The topics roughly correspond to the indicated chapters from Bisplinghoff et. al.,

- **Week 1:** Historical development and description of the aeroelastic phenomenon (Chapter. 1)
- **Week 2-4:** Review of aerodynamic and structural concepts (Chapters. 2, 3, 5)
- **Week 5-8:** Static Aeroelastic phenomenon (Chapter. 8)
  - Wing divergence
  - Control reversal
- **Week 9-13:** Dynamic aeroelasticity (Chapters. 9, 10)
  - Flutter
  - Unsteady aerodynamics
  - Gust response
- **Week 14-15:** Model testing (Chapters. 11, 12, 13)

Grading:

Grades are based on tests, homework, and a term paper followed by a presentation. You can write the term paper on a relevant topic of your choice, subject to my approval. You will give a presentation on the topic of your term paper to the entire class.

Test 1	20%
Test 2	20%
Test 3	20%
Term paper	25%
Homework	15%

Homework Policy:

Homework will be assigned at regular intervals over the entire semester. Assignments are to be turned in by the end of class the following week. Make sure that your homework is neat, legible, and well organized so that it is easy to follow and grade. Late homework will not be accepted except under unusual extenuating circumstances.

Examinations:

There will be three tests during the semester. A term paper and presentation will take the place of the final examination.

Attendance:

Regular attendance is expected.

Office Hours:

MWF 2:00pm-3:00pm. Feel free to stop by my office at any time to see if I am free to talk with you. You may also call ahead to see if I am available. You are also welcome to ask me questions by e-mail.

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.

Evaluation:

Note that 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. I will appreciate any feedback you can give me at that time (or earlier!) to help me improve the quality of the course.

Prepared by: Jayant Sirohi **Date:** 10 January 2013