



# COURSE OUTLINE

AVI 215	AERODYNAMICS
<b>Course Number</b>	<b>Course Title</b>
3	
<b>Credits</b>	2 lecture/ 2 laboratory hours

**Catalog description:**

Analysis of the fundamental theory and elements of applied aerodynamics. It provides the knowledge and background for safe and effective flying. The Lab explores the basic concepts of airfoil angle of attack and lift/drag characteristics.

**Prerequisites:** None

**Corequisites:** MAT 115

**Required texts/other materials:**

Aerodynamics For Naval Aviators  
H.H. Hurt, Jr.  
U.S. Government Printing Office

**Last revised:** Fall 2007

**Course coordinator:** Professor Joan Jones  
BS125  
609-570-3436

**Instructor Office Hours:** \_\_\_\_\_  
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\_\_\_\_\_

- Information resources:**
1. The Illustrated Guide to Aerodynamics by H.C. Smith
  2. FOILSIM, NASA's interactive web-based teaching aide
  3. Videos, guest speakers, additional texts which complement the information Presented in class

**Other learning resources:** The labs provide activities which illustrate concepts discussed in the lectures. Wind tunnel experiments will be utilized in the labs. Additional challenges are provided to allow students to explore topics in greater depth. Small group activities are also an integral component of the learning process.

**Course goals:**

***The student will be able to:***

- Describe the aerodynamic forces acting on an aircraft in flight and the variables affecting each one.
- Calculate the amount of lift being produced by an airfoil by utilizing the lift formula.
- Compare aircraft to measure the effects of drag and then be able to determine potential methods of reducing these effects.
- Explain the effects of planform design on flight and provide the rationale for specific planform selection.
- Evaluate and calculate aircraft performance data for the various flight regimes.
- Identify the types of aircraft stability and the impact on aircraft control and maneuverability.
- Trace the development of high speed flight and understand the latest technological advances in aircraft design.

**Course-specific General Education Core Competencies and Goals:**

The Student will be able to:

- Ask informed questions and make informed judgments (B.4)
- Solve problems by applying discipline-appropriate methods and standards (B.5)
- Recognize the value of using information to strengthen arguments and articulate a research question (D.1)
- Identify resources needed and develop and modify appropriate search strategies to obtain the information required to answer a research question (D.2)
- Integrate the information located in a cohesive manner that addresses the research question and communicate the information to the appropriate audience (D.4)

- Use a web browser and search engines to seek information and will recognize types of information and sources (E.4)
- Employ aspects of reflective thinking to solve problems utilizing brainstorming and consensus within collaborative projects (F.3)
- Will read, write, and listen actively, critically, and reflectively (1.1)
- Will write and speak clearly and effectively in formal American English (1.4)
- Will develop graphical, numeric, analytical and verbal models to describe quantitative relationships that exist in the world and explain the connections between these various models (2.1)
- Will draw logical conclusions by applying a variety of mathematical problem-solving strategies (2.3)
- Will demonstrate the ability to use a particular technology or group of technologies to analyze or solve problems in general or within their specific discipline (4.3)

### **Units of study in detail:**

#### **Unit I      WING AND AIRFOIL FORCES**

##### ***The student will be able to...***

- Identify the properties of the atmosphere and determine their aerodynamic effects
- Describe Bernoulli's Principle and Newton's Laws as they relate to incompressible airflow
- Define airfoil terminology and explain aerodynamic forces
- Illustrate Magnus Effect and the importance of circulation to lift

#### **Unit II      PLANFORM EFFECTS**

##### ***The student will be able to...***

- Describe the aerodynamic effects of planform
- Compare lift and stall patterns of various wing types
- Explain the effects of flaps and other high lift devices

#### **Unit III      AIRCRAFT DRAG**

##### ***The student will be able to...***

- *Differentiate between parasite and induced drag*
- *Explain drag characteristics including L/D max*
- *Describe the effects of speed, altitude, aspect ratio on drag*
- *Calculate Reynolds Number and understand its significance*

#### **Unit IV      AIRCRAFT PERFORMANCE**

##### ***The student will be able to...***

- Explain the various aspects of aircraft performance
- Predict takeoff, climb, maneuvering, range, endurance, and landing performance
- Determine how the various performance calculations are derived
- Compare the effects of variables such as power and weight on performance

**Unit V STABILITY**

*The student will be able to...*

- Differentiate between static and dynamic stability in aircraft
- Describe positive, neutral, and negative stability about the aircraft axes
- Determine design and loading factors and how they affect stability

**Unit VI HIGH SPEED FLIGHT**

*The student will be able to...*

- Trace the history of the breaking of the sound barrier
- Explain the problems associated with high speed flight
- Discuss unique flight characteristics of supersonic flight
- Investigate recent technological advancements in supersonic and hypersonic flight
- Hypothesize about future developments in aerodynamics and flight

**Evaluation of student learning:** Tests, quizzes, labs, assignments, attendance, and class participation will be considered for the final grading. The breakdown of grading is:

Tests	40 %
Quizzes	40 %
Labs, attendance, and participation	20 %

**Academic Integrity Statement:**

A student who knowingly represents work of others as his/her own, uses or obtains unauthorized assistance in the execution of any academic work, or gives fraudulent assistance to another student is guilty of cheating. The penalty for violating the honor code is severe (see Student Handbook). Any student violating the honor code is subject to receive a failing grade for the course and will be reported to the Office of Student Affairs. If a student is unclear about whether a particular situation may constitute an honor violation, the student should meet with the instructor to discuss the situation.

It is permissible to assist classmates in general discussions and such interaction is encouraged. Students must not work together on graded assignments unless it is a group assignment. A student may not use or copy (by any means) another's work or portions of it and represent it as his/her own.

**NOTE:**

- Students are required to take all tests on the date scheduled. No makeup tests will be permitted except for extremely serious circumstances.
- Students are expected to attend all of their classes. If a class is missed for any reason it is the student's responsibility to get any material, notes, handouts, announcements, etc.
- Students should be on time for class. If a student walks in late, it is expected that he/she enter the room quietly so that they do not disrupt the class meeting.
- Students are expected to follow ordinary rules of courtesy during class. Engaging in private conversations is distracting to the other students and the instructor.
- Disruptive behavior of any kind is not appropriate and the instructor reserves the right to have a student leave if he/she interferes with the other students' right to receive instruction.
- Cell phones should be turned off during class time. They are a distraction and can disrupt the learning environment.

- Assignments will not be accepted after the due date. Assignments submitted early can be reviewed by the instructor and assistance with their revision is available to students.