ABET Course Syllabus

# ENAE 311H Aerodynamics I (Honors)

**Credits & Contact Hours:** 3 credits (3 hours of lecture)

**Course Status:** Required

**Schedule:** Offered every Fall semester

**Course Description:** Fundamentals of aerodynamics. Elements of compressible flow. Normal and oblique shock waves. Flows through nozzles, diffusers and wind tunnels. Elements of the method of characteristics and finite difference solutions for compressible flows. Aspects of hypersonic flow.

**Pre-Requisites:** ENAE 283, MATH 246, must be in honors program

**Co-Requisites:** None

**Textbooks:** (1) J. Anderson. Fundamentals of Aerodynamics. McGraw Hill, fifth edition, 2010.
(2) J. Anderson. Modern Compressible Flow with Historical Perspective. McGraw Hill, third edition, 2002 (recommended).
(3) H. Liepmann and A. Roshko. Elements of Gasdynamics. Dover Publications, 2002 (recommended).
(4) R. Fox, P. Pritchard, A. McDonald. Introduction to Fluid Mechanics. Wiley, seventh edition, 2008 (recommended).
(5) G. Homsy. Multimedia Fluid Mechanics. Cambridge University Press, second edition, 2008 (recommended).

**Other Required Material:** Course lecture notes and handouts

**Course Oversight:** Aerodynamics and Propulsion Committee

**Syllabus Prepared By/Date:** Dr. Christopher Cadou in August, 2010

**Course Objectives/Student Learning Outcomes:**

1. A student who completes this course should understand the fundamentals and elements of compressible flows.

**Topics Covered:**

1. How to write generalized conservation equations for mass, momentum, and energy in a fluid
    a. Integral form
    b. Differential form
    c. Using indicial notation
2. How to compute an airfoil's lift, moment, and drag.
3. How to compute an aircraft's velocity using pressure measurements from a pitot tube
4. How to compute the change in pressure, temperature, and density across a shock wave.
5. How to compute the change in pressure, temperature, and density across an expansion wave.
6. How to design a nozzle.
7. How to design a supersonic wind tunnel test section.

8. How to design an experiment to measure pressure, temperature, velocity, and lift in a wind tunnel.

**Relationship of Course Objectives to Program Outcomes**

This course addresses program outcomes: 1, 3, 4, 5, 9