ABET Course Syllabus

# ENAE 311 Aerodynamics I

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

**Course Status:** Required

**Schedule:** Offered every fall semester and during the summer

**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

**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. Ashish Nedungadi, August 2010

**Course Objectives/Student Learning Outcomes:**

1. Ability to do simple calculations of both subsonic and supersonic internal flows in ducts such as nozzles
2. Ability to do simple calculations of diffusers and propulsion systems and external flows on slender airfoils

**Topics Covered:**

1. How to write generalized conservation equations for mass, momentum, and energy in a fluid
    a. Integral form
    b. Differential form
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 waves.
5. How to compute the change in pressure, temperature, and density across an expansion waves.
6. How to design a nozzle.

7. How to design a supersonic wind tunnel test section.

**Relationship of Course Objectives to Program Outcomes**

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