MAE 104
Aerodynamics (4 units)

Class/Laboratory Schedule: four hours of lecture, three hours of lab, and five hours of outside preparation. 12 hours/week total

Course Coordinator(s): Juan C Lasheras, Juan Carlos del Alamo

Textbooks/Materials:

1. Anderson, J.D. Fundamentals of Aerodynamics. (5th Edition) McGraw-Hill Series in Aeronautical and Aerospace Engineering 2010

Catalog Description: Basic relations describing flow field around wings and bodies at subsonic and supersonic speed. Thin-wing theory. Slender-body theory. Formulation of theories for evaluating forces and moments on airplane geometries. Application to the design of high-speed aircraft.

Prerequisites: MAE 101A-B. Enrollment restricted to engineering majors

Course Type: Required

Performance Criteria:
Objective 1
1.1 Students will demonstrate understanding of the basic principles of classical aerodynamics

Objective 2
2.1 Student will demonstrate ability to apply principles of analysis to formulate and solve engineering problems in aerodynamics

Objective 3
3.1 Student will demonstrate good problem solving skills and written analysis

Objective 4
4.1 Student will demonstrate familiarity and understanding of the basic principles of the design of airplane components
4.2 Students will demonstrate the ability to apply principles and perform analysis of complex systems

Objective 5
5.1 Student will demonstrate the ability to integrate theory and experimentation in the design of airplanes

Course Objectives:
(Number in parentheses refer to the MAE Program Outcomes)

1. To teach students the basic principles of classical aerodynamics. (1, ME10, AE12)

2. To trains students to apply principles of analysis to formulate and solve engineering problems in aerodynamics (1, ME10, AE12)

3. To encourage good problem solving skills and written analysis (1, 3)

4. To introduce students to the design and performance evaluations of wings and other lifting surfaces. (1, 2, 6, ME10, ME11, AE12)

5. To teach integration of theory and experimentation in the design of airplanes (1, 2, 6, ME10, ME11, AE12)

Course Topics:

1. Fundamental principles: aerodynamic variables, aerodynamic forces and, flow similarities, conservation of mass, momentum and energy in fluid flow, vorticity and circulation. Kelvin circulation theorem.
2. Fundamental of inviscid incompressible flow: stream function and velocity potential. Governing equation for irrotational, incompressible flows. The Kutta-Joukowski theorem and the generation of lift.
3. Incompressible flows over airfoils: classical thin airfoil theory, symmetric airfoil, cambered airfoil. Lifting flows over arbitrary shape bodies, the vortex panel method.
4. Incompressible flows over finite span wings: downwash and induced drag, Prandtl's classical lifting-line theory. Lifting-surface theory.
5. High speed aerodynamics: compressible flows, generation of shock waves and expansion waves. Supersonic flows over wedges and cones.
6. Supersonic flows through nozzles and diffusers
7. Subsonic compressible flows over airfoils: Linear theory

Last Updated: 11th July 2019