AA 302 COURSE DETAILS

TITLE:	Incompressible Aerodynamics
CREDITS:	4
FORMAT & SCHEDULE:	Lecture, 4 hours / week
FACULTY CONTACT:	Dana Dabiri

COURSE DESCRIPTION (Catalog Short Form, 50 words Max):

Aerodynamics as applied to the problems of performance of flight vehicles in the atmosphere. Kinematics and dynamics of flow fields; incompressible flow about bodies. Thin airfoil theory; finite wing theory.

COURSE OVERVIEW & LEARNING OBJECTIVES:

The main goal of this course is to learn about subsonic incompressible aerodynamics. Upon completion of this course, students will:

1. Understand basic properties of fluids.
2. Be able to develop the mass and momentum conservation laws.
3. Be able to calculate velocity fields, streamlines, vorticity and circulation.
4. Have the ability to solve airfoil problems using superposition.
5. Be able to calculate the lift and induced drag of a 3D wing.

COURSE REQUIREMENTS

PREREQUISITES: 1) PHYS 123
2) Either AMATH 351, MATH 136, or MATH 307.

REQUIRED TEXTBOOK: *Fundamentals of Aerodynamics*, John D. Anderson

COURSE SCHEDULE

Topics

Forces and moments, coefficients and COP ; BPT therom, flow similarity ; line, surface, volume integrals, continuity equation

Momentum equation ; Energy equation, substantial derivative, divergence ; stream/streak/pathlines

Angular velocity, vorticity, strain, circulation, streamfunction ; velocity potential, Bernoulli venturi tube &low ; Speed tun. Pitot tube pressure coefficient, Laplace equation

Uniform flow, source/sink ; uniform flow + source/sink ; Doublet, non-lifting flow over sylinder ; Vortex flow, lifting flow over vortex flow

Kutta-Joukowski, source panel method ; Circular cylinder example ; NACA nomenclature, vortex sheet

Kutta condition, Kelvin’s circulation theorem ; Thin Airfoil theory

Cambered airfoil aerodynamic center, vortex panel method ; Finite wing introduction, vortex filament, Prandtl lifting line theory

Elliptical lift distribution ; General lift distribution, Aspect Ratio ; Lifting surface theory : Vortex Lattice Method ; Delta wing

3D flow

Introduction to viscous flow