AA 301 COURSE DETAILS

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

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

Covers aerodynamics as applied to the problems of performance of flight vehicles in the atmosphere; kinematics and dynamics of flow fields; thin airfoil theory; compressible fluids; one-dimensional compressible flow; and two-dimensional supersonic flow.

COURSE OVERVIEW & LEARNING OBJECTIVES:

The main goal of this course is to learn about supersonic aerodynamics. Upon completion of this course, students will be able to:

1. Derive the equations of motion for a fluid.
2. Apply the equations of motion towards understanding normal shocks, and solve problems involving normal shocks.
3. Apply the equations of motion towards understanding oblique shocks and expansion wave, and solve related problems.
4. Understand supersonic flow through nozzles, wind tunnels and diffusers, and be able to design them.
5. Apply the equations of motion towards understanding compressible subsonic flows and solving related problems.
6. Use software program of choice (MATLAB, C++, PowerPoint, CorelDraw, etc) to design and present.

COURSE REQUIREMENTS

PREREQUISITES: Either A A 260 or M E 323.

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

COURSE SCHEDULE

Topics

Thermodynamics 1st law ; Compressibility, divergence, math identities, fluid models ; Equations of inviscid, compressible flow: continuity

Equations of inviscid, compressible flow : Momentum and Energy ; Substantial derivatives and stagnation conditions ; Normal shock equations and speed of sound

Energy equation ; Compressibility and shock wave properties ; Pitot tube and Hydraulic Jump

Oblique shocks ; Shock interactions and reflections ; Prandtl-Meyer expansion waves

Shock-expansion applications ; lift and drag coefficients ; Equations for Quasi-1D flow ; Nozzles

Under/over-expanded nozzle flows, diffusers ; Linearized velocity potential & comp. Corrections : Prandtl-Glauert & others

Critical Mach number, sound barrier, area rule ; Linearized supersonic flow

Numerical methods : supersonic flow ; Viscous flow : Introduction and N.S. equations

Subsonic couette flow

Introduction to boundary layers