Official Syllabus
MAE 5420 – Compressible Fluid Flow
Elective

Course Description:
Application of conservation of mass, momentum and energy to the design and analysis of compressible fluid systems. 3 credits, F.

Prerequisites: MAE 3400, MAE 3420.

Textbooks: *Modern Compressible Flow with Historical Perspectives*, 3rd Edition, John D. Anderson, Jr., McGraw-Hill.

Course Objectives:
To establish the necessary physical and thermodynamic background and then develop the fundamental concepts that will allow the student to solve practical compressible flow problems.

Topics Covered:
- Thermodynamics review
- Integral forms of conservation equations for inviscid flow
- One-dimensional flow
- Normal shock relations
- Quasi-one-dimensional flow
- Oblique shocks and Prandtl-Meyer expansion
- Supersonic flow over flat plate
- 2-D Supersonic airfoil, Wave Drag
- Introduction to turbulent boundary layers in high-speed flows
- Skin friction models
- Effects of skin friction on supersonic lift-to-drag ratio
- Detached shockwaves
- Supersonic drag on blunt leading edge
- Flow through multiple shock systems
- Application to supersonic inlet design
- Method of characteristics as applied to nozzle design
- Introduction to differential form of conservation equations
- Supersonic conical flow
- Taylor-Maccoll solution
- Hypersonic flow
- Non-adiabatic shockwaves

Class Schedule: Three 50 minute classes; M-W-F

Course Contribution:
Mathematics and Basic Sciences: 0 credit hour(s).
Engineering Sciences and Design: 3 credit hour(s).
General Education Component: 0 credit hour(s).

Course Assessment Measures:
1. Midterm Exam (30%)
2. Final Exam (30%)
2. Homework/Programming Assignments (40%)

Professional Component Content			
Math & Basic Sciences	Engineering Topics	General Education	Engineering Design
✓	✓		

Relationship of course to program outcomes:

	Student Outcomes	Course * Outcomes
a)	an ability to apply knowledge of mathematics, science, and engineering,	✓
b)	an ability to design and conduct experiments, as well as to analyze and interpret data,	
c)	an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	
d)	an ability to function on multi-disciplinary teams,	
e)	an ability to identify, formulate, and solve engineering problems,	✓
f)	an understanding of professional and ethical responsibility	
g)	an ability to communicate effectively	
h)	the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	
i)	a recognition of the need for, and an ability to engage in life-long learning	
j)	a knowledge of contemporary issues,	
k)	an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	✓
l)	an ability to work professionally in both thermal and mechanical system areas including the design and realization of such systems.	✓
*An ✓ indicates that this course helps the students to achieve the Program Outcomes.		

Course Coordinator: Stephen A. Whitmore

Last Updated: July 13, 2013.