

ME 432: Principles of Gas Dynamics
Fall or Spring Semester Elective

- Type (check one):** Required: _____ Elective: _____
- 2005-2006 Catalog Data:** Concepts of compressible flow. Steady streamtube flow. Supersonic flow and shock waves. Prandtl-Meyer flow. Supersonic nozzle and diffuser flow. Fanno and Rayleigh flow. Unsteady one-dimensional flow. *One semester; three credits*
- Prerequisites:** ME 305
- Co-Requisites:** None
- Textbook:** J.D. Anderson, *Modern Compressible Flow*, Third Edition, McGraw-Hill, 2003.
- Other Required Materials:** None
- Other References:** R.D. Zucker and O. Biblarz, *Fundamentals of Gas Dynamics*, Second Edition, Wiley, 2002.
J.E.A. John, *Gas Dynamics*, Second Edition, Prentice Hall, 1984.
- Instructor:** Dr. L. Michael Santi, Professor of Mechanical Engineering
- Course Objectives:**
1. Develop understanding of one-dimensional compressible flow
 2. Develop understanding of wave phenomena in compressible flow
 3. Develop understanding of special flows (Fanno line, Rayleigh line)
 4. Develop understanding of shock phenomena
 5. Develop understanding of computational methods for flow description
- Prerequisites by Topics:**
1. Differential and integral calculus
 2. Thermodynamics through the second law
- Topics:**
1. Review of thermodynamic properties and processes
 2. Conserved quantities in steady flow
 3. Speed of sound, Mach number
 4. Stagnation properties
 5. Quasi-one-dimensional flow
 6. Isentropic flow with area change
 7. Rayleigh Line
 8. Fanno Line
 9. Normal shocks
 10. Oblique shocks
 11. Unsteady wave motion
 12. Method of characteristics
- Class Schedule:** Three 50-minute sessions per week

Prepared by: Dr. L. Michael Santi

Date: 10-Jan-05

**Professional Component:
ME 432 – Principles of Gas Dynamics**

Category (check one)	<input type="checkbox"/> Math/Basic Science <input checked="" type="checkbox"/> Engineering <input type="checkbox"/> General Education <input type="checkbox"/> Other
Design (check one)	<input type="checkbox"/> Significant <input checked="" type="checkbox"/> Some <input type="checkbox"/> None
Realistic Constraints (check all that apply)	<input type="checkbox"/> Economic <input type="checkbox"/> Environmental <input type="checkbox"/> Sustainability <input type="checkbox"/> Manufacturability <input type="checkbox"/> Ethical <input type="checkbox"/> Health & Safety <input type="checkbox"/> Social <input type="checkbox"/> Political

Relationship to Program Outcomes:

Check all that apply:

- (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
- (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 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