North Dakota State University
Department of Mechanical Engineering
ME 753 – Gas Dynamics
2013 Fall Semester
TuTh 12:30pm -1:45pm
Dolve 115

Instructor: Dr. Y. Bora Suzen
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Office Hours: TuTh 2:00pm – 3:00pm

Prerequisites:

Students attending this course are assumed to have taken undergraduate courses in thermodynamics similar to ME 351, fluid dynamics similar to ME 352 and heat transfer similar to ME 454.

Suggested References:

1. John D. Anderson, *Modern Compressible Flow with Historical Perspective*, 3rd Edition, McGraw-Hill, 2003.
2. Ascher H. Shapiro, *The Dynamics and Thermodynamics of Compressible Fluid Flow*, (Vols. 1 and 2), John Wiley and Sons, 1953.
3. H. W. Liepmann and A. Roshko, *Elements of Gas Dynamics,* John Wiley and Sons, 1957.
4. P. A. Thompson, *Compressible Fluid Dynamics,* McGraw-Hill, 1972.
5. W. G. Vincenti and C. H. Kruger, *Introduction to Physical Gas Dynamics,* John Wiley and Sons, 1967.
6. Hosoi, Anette. *2.26 Compressible Fluid Dynamics, Spring 2004*. (MIT OpenCourseWare: Massachusetts Institute of Technology), http://ocw.mit.edu/courses/mechanical-engineering/2-26-compressible-fluid-dynamics-spring-2004 (Accessed 27 Aug, 2013).

Course Description:

Fundamental concepts of fluid dynamics and thermodynamics are used in the treatment of compressible flow, frictional flows, and flows with heat transfer or energy release. (3 Credits).

Course Goals and Anticipated Course Outcomes:

The goal of this course is to cover the fundamental concepts for the compressible flow of gases. Topics to be covered include: appropriate conservation laws; propagation of disturbances; isentropic flows; normal shock wave relations, oblique shock waves, weak and strong shocks, and shock wave structure; compressible flows in ducts with area changes, friction, or heat addition; heat transfer to high speed flows; unsteady compressible flows, Riemann invariants, and piston and shock tube problems; steady 2D supersonic flow, Prandtl-Meyer function; and self-similar compressible flows. The emphasis will be on physical understanding of the phenomena and basic analytical techniques.

Assessment:

Your level of success in attaining the anticipated course outcomes will be assessed during the semester by homework/computer assignments, examinations, and computer projects. ***The format of your solutions in homework, projects, and the exams should be in acceptable engineering form.***

(a) Homework Assignments: Homework assignments will include problems based on both analytical and computer solutions. Assignments will typically be collected on a weekly basis.

(b) Examinations: There will be three examinations during the semester and one exam at the scheduled final exam date. Students who fall ill, or who know they will be missing an exam for a valid reason (e.g. Family emergency) are encouraged to notify the instructor by phone or e-mail prior to the exam, if at all possible. Students missing an exam without a valid excuse will receive a grade of zero for that exam.

Grading Policy:

The grade distribution is:

Homework:	20%
4 Exams (20% each):	80%
Total	100%

Final course grades will be assigned according to the following scale:

A	90-100%
B	80-89%
C	70-79%
D	60-69%
F	below 60%

The final grades will NOT be curved

Additional Information:

1. Unless specifically stated, **all assigned work is assumed to be performed individually.**
2. Course assignments, calendar, announcements etc. will be posted on Blackboard on regular basis, you will need to login and check https://bb.ndsu.nodak.edu/ for announcements and online assignments.
3. The academic community is operated on the basis of honesty, integrity, and fair play. All work in this course must be completed in a manner consistent with Code of Academic Responsibility and Conduct, NDSU Policy 335: Code of Academic Responsibility and Conduct applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the Office of Registration and Records. Informational resources about academic honesty for students and instructional staff members can be found at www.ndsu.edu/academichonesty.
4. Any students with disabilities or other special needs, who need special accommodations in this course are invited to share these concerns or requests with the instructor and contact the Disability Services Office as soon as possible.

Tentative Course Topics and Schedule:

Topics	Chapters (Ref. 1)
1. Introductory Remarks	Chapter 1
2. Review of Equations of Fluid Motion	Chapter 2
3. One-Dimensional Flow	Chapter 3
Exam 1	
4. Oblique Shock/Expansion Waves	Chapter 4
5. Quasi-One-Dimensional Flow	Chapter 5
Exam 2	
6. Unsteady Wave Motion	Chapter 7
7. Velocity Potential Equation	Chapter 8
Exam 3	
8. Linearized Theory	Chapter 9
9. Introduction to Method of Characteristics	Chapter 11
Exam 4	