INTRODUCTION TO COMPRESSIBLE FLOW
EML 5714 & EAS 4132
Fall 2023

Instructor:

Lawrence Ukeiley
Office: Room 312, MAE-A
E-mail%: ukeiley@ufl.edu
Phone: (352) 392-9459
% This will be the best way to contact me.

Teaching Assistant:

A TA will be responsible for grading all homework assignments and will be announced as soon as the details are worked out and their contact information will be posted on the course website.

Office Hours:

TBA on Canvas Web Page
Additionally, if a student cannot make scheduled office hours please reach out to me through email and I will do my best to accommodate meeting at a different time.

Course Communication

The instructor will send out all communication through Canvas. All students will be held responsible for any information disseminated through the course website or spoken in class. For general course questions, questions about grades, or personal issues please reach out to me You are welcome to do this through email or during office hours or feel free to request an appointment to talk with the instructor either in person or some type of phone or video conferencing. If you have an issue or need help, don't wait to ask about it. Problems are generally easier to solve sooner rather than later.

Required Textbook:

John and Keith, "Gas Dynamics," Third Edition, Prentice Hall

Reference Books:

Zucker and Biblarz, "Fundamentals of Gas Dynamics"
Zucrow and Hoffman, "Gas Dynamics," Volume 1, Wiley 1976
Modern Compressible Flow, J. D. Anderson, Jr., Third Edition, McGraw Hil,l
Saad, "Compressible Fluid Flow," Prentice Hall, 1993

Course Prerequisites:

There are no pre-requisites listed in the catalog. This course is intended for undergraduate students and for graduate students who have no previous background in compressible flow. In teaching the course I assume that you have had an introductory fluid mechanics course (EGN3353C or equivalent) or Aerodynamcis (EAS 4101 or equivalent) and an introductory thermodynamics course (EML3100 or equivalent). I also assume you have a working knowledge of computer programming (student's choice of programming language). **Graduate students who have taken a previous course in one-dimensional compressible flow should NOT take this course** and instead consider EAS6138 Gas Dynamics, which covers more advanced topics in multi-dimensional compressible flow analysis.

Course Objective:

In this course you will learn how to apply concepts developed in introductory fluid mechanics and thermodynamics courses to analyze one-dimensional and quasi-one-dimensional compressible flows. Phenomena to be explored including Mach waves, normal shocks, oblique shocks, Prandtl-Meyer

expansions, isentropic flow with area change, Fanno flow and Rayleigh flow. The skills developed are important to a variety of mechanical and aerospace engineering applications.

Class Schedule:

When: MWF 2nd Period (8:30 – 9:20 Eastern Time)

Where: NEB 202*

* Classes will be recorded, however if you are able to attend you should as this makes the class more conducive to learning the material. Additionally, there will be some instances throughout the semester when you will be required to be available during the class period with the exception of students for the EML 5714 EDGE Sections.

Policies and Procedures:

Since this course has both undergraduate and graduate in order to distinguish between the student's levels, students registered for EML 5714 will be required to perform a journal article review project and periodically some extra homework assignments and test questions.

Homework:

Periodically problems will be assigned with a due date specified. ***All homework assignments must be turned in through the e-learning website.*** Late homework's will not be accepted. Hardship cases are rare but will be considered on an individual basis and only if the instructor has been contacted ***before*** the due date of the assignment.

Exams:

Three exams will be given during the semester during the regularly scheduled class time. Excuses from exams will only be given for approved incidences of those required by university policy. If there is a conflict it is on the student to contact me before the scheduled exam time and some type of arrangement will be made.

Tentative Exam Schedule

Exam 1: September 27th
Exam 2:October 27th
Exam 3:December 1st

Wind Tunnel Project:

For this project students will be asked to help design a wind tunnel for the fluids laboratory. Details of the project will be given out during the semester and given at least 1 month to work on it, and it will be due the last day of class (12/6). Students in EML 5714 will likely have an extra component to this project.

Journal Article Review Project (EML 5714 only):

For this project students will be asked to select an article from an archival journal related to compressible flows and perform a technical review of it.

Grading (EML 5714):

Grades will be determined using these weights: 6% Homework, 6% Review Project, 22% Exam 1, 22% Exam 2, 22% Exam 3 and 22% Wind Tunnel Project.

Grading (EAS 4132):

Grades will be determined using these weights: 12% Homework, 22% Exam 1, 22% Exam 2, 22% Exam 3 and 22% Wind Tunnel Project

Grading Scale (EML 5714 and EAS 4132)

A: 93-100, A-: 90-92.9, B+:89.9-87, B: 86.9-83, B-: 82.9-80, C+: 79.9-77, C: 76.9-73, C-: 72.9-70, D+: 69.9-67, D: 66.9-63, D-: 62.9-60, E: <55

Online Course Recording

Our class sessions may be audio-visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting https://disability.ufl.edu/students/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use and Copyrighted Material

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use and the use of copyrighted material. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html

Campus Resources:

Health and Wellness

U Matter, We Care:
Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: http://www.counseling.ufl.edu/cwc, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

Academic Resources

E-learning technical suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. https://www.crc.ufl.edu/.

Library Support*,* http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall*,* 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus*:* https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

On-Line Students Complaints*:* http://www.distance.ufl.edu/student-complaint-process.

Topics to be Covered:

- Steady One-Dimensional Compressible Flow
- Normal Shock Waves (stationary and Moving)
- Oblique Shock Waves
- Expansion Waves Prandtl-Meyer Flow
- Isentropic Variable Area Flow
- Adiabatic Flow in a Duct with Friction
- Flow with Heat Addition of Removal
- Generalized Quasi-One Dimensional Flow
- Compressible Potential Flow
- Experimental Techniques for Compressible Flows