

Compressible Flow

EAS 4132 / EML 5714, Spring 2021, M W F, Period 2, 8:30 AM - 9:20 AM

Professor

Assistant Professor S. A. E. Miller, Ph.D.
University of Florida Department of Mechanical and Aerospace Engineering
MAE-A 220, Gainesville, FL 32611, PO Box 116250
Preference - please contact through the canvas website <https://ufl.instructure.com>

Spring 2021 “Flipped” Class

- Due to COVID-19 the Compressible Flow course is online in a ‘flipped’ format.
- Students will watch pre-recorded lectures at their own pace for each module.
- The normal class time will be used to answer pre-prepared questions by the students, discuss current events in compressible flow, special topics, and historical events.
- Students are expected to come with excellent pre-prepared highly technical questions to the Question & Answer (Q&A) sessions.

Q&A and Office Hours

M W F, 8:30–9:20 AM, online or via confirmed written appointment.

Teaching Assistants

N/A

Course Objectives

This course will introduce students to the theory, physics, and analytical solutions of compressible fluid flow phenomena. We will examine the physics of shock waves, expansion waves, Mach waves, isentropic flow through nozzles and inlets, briefly examine Fanno/Rayleigh flow, wind tunnels, transonics, hypersonics, supersonics, and additional select topics. Illustrations and photographs of the phenomena will be presented. Application of the material will be given in the context of the professor’s research, contemporary developments, and historical perspective. The material will be presented through lectures, assigned reading, and the class website. At the end of the course the students will possess the foundational knowledge of compressible flow.

Course Description

Course catalogue, “One-dimensional and quasi-one-dimensional compressible fluid flows. Includes Mach waves, normal shocks, oblique shocks, Prandtl-Meyer expansions, isentropic flow with area change, Fanno flow, and Rayleigh flow.” (Credits 3)

Course Pre-Requisites / Co-Requisites

EAS 4101 (Aerodynamics) and/or EGN 3353C (Fluid Mechanics), or consent of professor.

Recommended Textbooks and/or Software

Various handout material provided digitally by professor. No software is required. A scientific calculator is highly recommended.

Supplemental Materials

- John, J. E. and Keith, T. G., ‘Gas Dynamics,’ Pearson Prentice Hall, Ed. 3, ISBN: 9780131206687, 2006.
- Oosthuizen, P. H. and Carscallen, W. E., ‘Introduction to Compressible Flow,’ CRC Press, Ed. 2, ISBN: 9781439877913, 2013.
- Liepmann, H. W. and Roshko, A., ‘Elements of Gas Dynamics,’ Dover, 2001.
- Anderson, J., ‘Modern Compressible Flow: With Historical Perspective,’ McGraw-Hill, Ed. 3, ISBN: 978-0072424430, 2003.

- Various handout material provided by professor.

Materials, Software, and Supplies

None.

Important Dates

- Exam and homework dates are introduced in class or through the class website.

Attendance Policy

- It is expected that students attend class.
- Required statement by the University of Florida: Excused absences are consistent with university policies in the undergraduate catalog ([link](#)) and require appropriate documentation.

Class Expectations

- The student is responsible for their education. The professor is the guide to their understanding of the field.
- In class students (does not apply to online students) - Cell phones, laptops, etc.: Under no circumstances will devices be used in the classroom. Students are expected to take handwritten notes.

Policy on Deadlines

- Late submission of class material is not accepted.
- If a tragedy has occurred then instructor notifications are required. See <https://care.dso.ufl.edu/instructor-notifications> for details. Note that, "Professors have the right to accept or reject the notification."

Policy on Ethics and Cheating

Any kind of cheating, lying, dishonesty, or honor code violations results in a failing grade of the entire course.

Evaluation of Grades and Grading Policy

Course Grade Evaluation Criteria

- Undergraduate sections: The graded material will be weighted as 0.20 for homework, 0.20 for exam one, 0.20 for exam two, and 0.40 for final exam.
- Graduate sections: The graded material will be weighted as 0.10 for homework, 0.10 for the term paper, 0.20 for exam one, 0.20 for exam two, and 0.40 for final exam.
- Graduate students who do not submit a term paper will receive an incomplete grade (I).
- The final grade will be assigned via the straight scale: 4.00 (A) → [93.33, 100.00], 3.67 (A-) → [90.00 to 93.33), 3.33 (B+) → [86.67 to 90.00), 3.00 (B) → [83.33 to 86.67), 2.67 (B-) → [80.00 to 83.33), 2.33 (C+) → [76.67 to 80.00), 2.00 (C) → [73.33 to 76.67), 1.67 (C-) → [70.00 to 73.33), 1.33 (D+) → [66.67 to 70.00), 1.00 (D) → [63.33 to 66.67), 0.67 (D-) → [60.00 to 63.33), and 0.00 (E) → [00.00 to 60.00). Final grades are rounded to the nearest hundredths place before assignment.
- At the discretion of the professor, the final course grades may be curved and all students may receive higher grades.

Homework

- The purpose of homework is to learn and understand the material. Students are responsible for understanding the homework problems and solutions.
- Students who turn in fully completed homework will receive 100% credit. All original work must be shown. Answers must be boxed with units. Partial solutions of the homework will be posted on the class website after the due date. Students will submit solutions of the homework problems via the course website. Only PDF files are accepted.

Term Paper

Students in the graduate section are expected to write a term paper. The details of the assignment, format, and deadline are posted on the class website. The paper must be of AIAA Journal submission quality.

Grade Corrections

Corrections of grades must be submitted promptly within 3 business days after grade posting in writing via canvas with a concise statement of why there has been an error.

Required Information by the University, College, and Department

UF Graduate School Policy: Letter grades of C-, D+, D, D- or E are not considered passing at the graduate level. Although the grade points associated with these letter grades are included in grade point average calculations, courses with these grades will not be credited towards graduation. Also, grades of B-, C+ or C count toward a graduate degree if an equal number of credits in courses numbered 5000 or higher have been earned with grades of B+, A- and A, respectively. Further explanation of graduate grading policies can be found at <http://gradcatalog.ufl.edu/content.php?catoid=12&navoid=2750#grades>.

Professional Component (ABET):

This course is designed primarily for students of the mechanical and aerospace disciplines. Students within other engineering majors, mathematics, and physics will benefit from this course. The course content is 100% engineering science.

Relation to Program Outcomes (ABET):

Relation to Program Outcomes (ABET):

Outcome	Coverage*
a. Apply knowledge of mathematics, science, and engineering	High
Design and conduct experiments, as well as analyze and interpret data	
c. 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. Function on multidisciplinary teams	
e. Identify, formulate, and solve engineering problems	High
f. Understand professional and ethical responsibilities	Medium
g. Communicate effectively	
Understand the impact of engineering solutions in a global, economic, environmental, and societal context	Medium
i. Recognize the need for and be able to engage in lifelong learning	Medium
j. Understand contemporary issues	High
k. Use the techniques, skills, and modern engineering tools necessary for engineering practice	High

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not part of the course.

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.ua.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.ua.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

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. 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: <https://registrar.ufl.edu/ferpa.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 Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

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 support, 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://care.dso.ufl.edu>.

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