

EGN 3353C: Fluid Mechanics

Class Periods: T 8:30 – 10:25 AM; R 9:35 – 10:25 AM

Location: MAEB 0238

Academic Term: Spring 2023

Instructor

Ryan Houim

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MAE-A 316

(352)-392-7164

Tentative Office Hours: M, 1:00 – 2:00; W 1:00-2:00 (Subject to change - Please pay attention to Canvas announcements)

Preferred Contact: Please contact through the canvas website <https://ufl.instructure.com>

Teaching Assistants

To be determined

Course Website

<https://ufl.instructure.com/> (Canvas)

Additional material will be uploaded on the Canvas website. Please check Canvas before each lecture.

Course Description

Statics and dynamics of incompressible fluids. Application to viscous and inviscid flows. Dimensional analysis. Compressible flow. Credits: 3

Course Pre-Requisites / Co-Requisites

MAC 2313, EGM 2511 and EML 3100, or EML 3007

Course Objectives

This course provides an introduction to fluid mechanics. It stresses fundamental engineering science principles applied to fluid mechanical systems. Students will learn the governing integral and differential equations for viscous and inviscid fluids and will apply these equations to internal and external flows. Upon completion of this course, students are expected to have developed a working understanding of the basic theory of incompressible flow. Students will learn problem-solving techniques and have the opportunity to apply these techniques to a variety of problems.

Materials and Supply Fees

None

Required Textbooks and Software

Incomplete course notes will be provided on Canvas

Philip Gerhart, Andrew Gerhart, John Hochstein, “Munson, Young, and Okishii's Fundamentals of Fluid Mechanics,” 9th Edition, Wiley, ISBN-9781119598114

This course is participating in UF All Access, which is a program designed to provide the most affordable option for students. <https://www.bsd.ufl.edu/G1C/bookstore/allaccess.asp>

- The required course material is delivered digitally through WileyPlus, containing a fully searchable e-text and the required homework for this course. You may purchase an access code at a discounted price by going to this link:

<https://www.bsd.ufl.edu/G1C/bookstore/UFAllAccessInstructions.pdf>

This link authorizes the cost of the access code to be charged directly to your student financials account.

Important Dates

Classes Begin: Jan. 9

Holidays/Reading Days: Jan. 16, Mar. 11-18, Apr. 27-28

Classes End: Apr. 28

Attendance Policy

This class has no attendance policy; however, students are expected to attend each lecture. Material that is not covered in the textbook will often be discussed in class. Also, *the weekly quizzes and concept quizzes will be given in class only.*

Evaluation of Grades

Homework	10%
Concept Quizzes	15%
Quizzes	50%
Final	25% (May 3, 3:00 PM – 5:00 PM)

Homework

Homework will be assigned on a roughly weekly basis and due on Tuesdays. ***Please submit your solutions ONLY via Canvas. The lowest Homework score will be dropped. Late Homework Submissions will not be accepted.*** The HW problems may be downloaded from the course web site <https://lss.at.ufl.edu/> (use Canvas system).

Students are encouraged to collaborate with their colleagues; however, each student will turn in their homework individually. Copying homework problems from solution manuals and other resources will be considered cheating and will not be tolerated.

Concept Quizzes

At least 10 concept quizzes will be given throughout the semester typically on Tuesdays. These are short 5-minute quizzes that test student's understanding of basic concepts. ***The two concept quizzes with the lowest score will be dropped. Late or makeup concept quizzes will not be given*** due to the drops.

Quizzes

At least 10 quizzes will be given throughout the semester. These quizzes will typically be given in-class on Thursdays. ***The two quizzes with the lowest score will be dropped. Late or makeup quizzes will not be given*** due to the quiz drops.

These quizzes are essentially one-problem exams. You must show *correct work* to receive full credit in cases where the answer to the homework, quiz, or exam problem is given. You will receive a *zero* on such problems if incorrect work miraculously gives the correct answer.

Make-up Exam Policy

Make-up exams will be allowed only under the most extenuating circumstances as required by University policy. Please notify the instructor of any anticipated conflicts prior to the exam. See <https://care.dso.ufl.edu/instructor-notifications>. Note that, “Professors have the right to accept or reject the notification.”

Grading Policy

The instructor may adjust this scale in the final analysis, but in no case will scores be higher than those listed be required to achieve the stated letter grades.

Percent	Grade	Grade Points
93.0 - 100.0	A	4.00
90.0 - 92.3	A-	3.67
87.0 - 89.9	B+	3.33
83.0 - 86.9	B	3.00
80.0 - 82.9	B-	2.67
77.0 - 79.9	C+	2.33
73.0 - 74.9	C	2.00
70.0 - 72.9	C-	1.67
67.0 - 69.9	D+	1.33
63.0 - 66.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:

<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades>
<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Grade Dispute and Regrades

If there is a mistake in grading or you think that you have been graded unfairly, explain your dispute with the instructor within **one week** after the assignment, quiz, exam, etc. is returned. After one week, the grade dispute will **not** be considered.

The **entire** assignment or quiz will be re-examined if a student wants a re-grade on a problem.

Use of Class Materials

The materials used in this class, including, but not limited to, exams, quizzes, and homework assignments are copyright protected works. Any unauthorized copying of the class materials is a violation of federal law and may result in disciplinary actions being taken against the student. Additionally, the sharing of class materials without the specific, express approval of the instructor may be an act of academic dishonesty, which could result in further disciplinary action. This includes, among other things, uploading class materials to websites for the purpose of sharing those materials with other current or future students.

Class Expectations

- The student is solely responsible for their education. The professor is the guide to their understanding of the field.

- Cell Phones, Laptops, etc.: Under no circumstances will electronic devices be used in the classroom without the permission of the professor. Students are expected to take notes.
- Respect and Disruption: The professor and students will be respectful at all times. Classroom disruption of any kind will not be tolerated.

Professional Component (ABET):

This course utilizes fundamentals of mathematics, physics, and chemistry to develop analytical methodologies for engineers to utilize for design and analysis work of fluid machines and systems.

Mathematics	35%
Physical Sciences	50%
Engineering Design	10%
Social Sciences & Humanities	5%

Relation to Program Outcomes for EML 4930 (ABET):

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	High
2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	Medium
3) an ability to communicate effectively with a range of audiences	
4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	
5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	
6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	
7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies	

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

Course Outline and Schedule

0. Review of Vectors and Vector Calculus: *In-Class Notes* (~1 lecture)
1. Introduction: *Chapter 1* (~1.5 Weeks)
2. Fluid Statics: *Chapter 2* (~2 Weeks)
 - a. Pressure variation in a static liquid: *Sections 2.1 – 2.3*
 - b. Standard Atmosphere: *Section 2.4*
 - c. Manometry: *Section 2.6*
 - d. Hydrostatic Forces on submerged objects: *Section 2.8 – 2.10*
 - e. Buoyancy and Stability: *Section 2.11*
3. Bernoulli Equation: *Chapter 3* (~1.5 Weeks)
 - a. Newton’s 2nd Law on a fluid element: *Sections 3.1 – 3.3*

- b. Static, Stagnation, Dynamic, and Total Pressure: *Section 3.5*
 - c. Examples of the Bernoulli Equation: *Section 3.6 – 3.7*
 - d. Restrictions on the Bernoulli Equation: *Section 3.8*
- 4. Fluid Kinematics (~1.5 Weeks)
 - a. Velocity and Acceleration Fields: *Section 4.1 – 4.2*
 - b. Control Volume and System Representations: *Section 4.3*
 - c. Reynolds Transport Theorem: *Section 4.4*
- 5. Finite Control Volume Analysis: *Chapter 5* (~3 Weeks)
 - a. Conservation of Mass: *Section 5.1*
 - b. Conservation of Momentum: *Section 5.2*
 - c. Conservation of Energy: *Section 5.3*
- 6. Differential Analysis: *Chapter 6* (~ 1 Week)
 - a. Fluid Element Kinematics: *Section 6.1*
 - b. Conservation of Mass: *Section 6.2*
 - c. Linear Momentum Equation: *Section 6.3*
 - d. Elements of Inviscid Flow: *Section 6.4*
 - e. Navier-Stokes Equations and Computational Fluid Dynamics: *Sections 6.8- 6.9*
- 7. Dimensional Analysis: *Chapter 7* (~1 Week)
 - a. Buckingham-Pi Theorem and Dimensionless Groups: *Sections 7.1 – 7.7*
 - b. Modeling and Similitude: *Sections 7.8 – 7.9*
- 8. Internal (Pipe) Flow: *Chapter 8* (~2 Weeks)
 - a. Laminar Flow: *Sections 8.1-8.2*
 - b. Turbulent Flow: *Sections 8.3*
 - c. Friction Factor, Moody Diagram, Major and Minor Losses: *Section 8.4*
 - d. Solution of Pipe Flow Problems: *Section 8.5*
 - e. Flow Measurement Methods (Time Permitting): *Section 8.6*
- 9. External Flow: *Chapter 9* (~1 Week)
 - a. Concept of Drag, Lift, and Boundary Layers: *Sections 9.1 – 9.2*
 - b. Drag and Lift: *Sections 9.3 – 9.4*
- 10. Introduction to Compressible Flow (Time Permitting): *Chapter 11*

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure 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/>.

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session. Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

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://www.dso.ufl.edu/sccr/process/student-conduct-honor-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.

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: <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 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://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

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