EGN 3353C: Fluid Mechanics

Class Periods: T-10:40-11:30; R-10:40-12:35
Location: MCCA G186
Academic Term: Spring 2020

Instructor
Ryan Houim
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MAE-A 316
(352)-392-7164
Office Hours: T 1:00 – 2:00; W 1:200 (Subject to change - Please pay attention to Canvas announcements)
Preferred Contact: Please contact through the canvas website https://ufl.instructure.com

Teaching Assistants
Brayden Roque
braydenroque@ufl.edu
Office Hours: MW 3:00 – 5:00

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
Philip Pritchard & John Mitchell, "Introduction to Fluid Mechanics," 9th Edition, Wiley, ISBN-9781118912652
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 etext 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. 6
Holidays/Reading Days: Jan. 20, Mar. 2-6, Apr. 23-24
Classes End: Apr. 24

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.

Evaluation of Grades
Homework	20%
Quizzes	55%
Final	25% (April 30, 7:30 AM – 9:30 AM)

Homework

Homework will be assigned on a roughly weekly basis and is due at the start of class on the announced due date.

Please submit your solutions ONLY via Canvas. 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.

Quizzes
At least 9 quizzes will be given throughout the semester. These quizzes will be given in-class on Thursdays. **The quiz with the lowest score will be dropped. Late or makeup quizzes will not be given** due to the quiz with the lowest score being dropped.

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."

Problem Solution Format

You MUST fullow the homework format on

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
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.

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

0. Review of Vectors and Vector Calculus: *In-Class Notes*
1. Introduction: *Chapter* 1
2. Fundamental Concepts: *Chapter 2*
3. Fluid Statics: *Chapter 3*
   a. Pressure variation in a static liquid: *Sections 3.1 – 3.3*
   b. Hydrostatic Forces on submerged objects: *Section 3.4*
   c. Buoyancy and Stability: *Section 3.5*
4. Integral Form of the Conservation Equations – Control Volume Analysis: *Chapter 4*
   a. Conservation Laws and Reynolds Transport Theorem: *Section 4.1-4.2*
   b. Conservation of Mass: *Section 4.3*
   c. Conservation of Momentum: *Section 4.4*
   d. Conservation of Angular Momentum (Time permitting): *Section 4.6*
   e. Conservation of Energy: *Section 4.8*
5. Differential Form of the Conservation Equations: *Chapter 5*
   a. Conservation of Mass: *Section 5.1*
   b. Fluid Kinematics – Material Derivative: *Section 5.3*
   c. Momentum Equation – Navier-Stokes: *Section 5.4*

6. Inviscid Flow: *Chapter 6*
    a. Momentum Equation for Inviscid Flow: *Section 6.1*
    b. Bernoulli Equation: *Section 6.2* (Note this will combine with problems from Ch 2 and 4)
7. Dimensional Analysis: *Chapter 7*
    a. Buckingham-Pi Theorem and Dimensionless Groups: *Sections 7.2 – 7.4*
    b. Flow Similarity: *Section 7.5*
8. Internal (Pipe) Flow: *Chapter 8*
    a. Laminar Flow: *Sections 8.1-8.3*
    b. Shear stress and turbulent velocity distributions: *Sections 8.4-8.5*
    c. Head Loss – Friction Factor, Moody Diagram, Major and Minor Losses: *Sections 8.6-8.7*
    d. Solution of Pipe Flow Problems: *Section 8.8*
    e. Flow Measurement Methods (Time Permitting): *Section 8.9*
9. External Flow: *Chapter 9*
    a. Concept of a Boundary Layer: *Section 9.1*
    b. Drag and Lift: *Sections 9.6-9.7*
10. Introduction to Compressible Flow (Time Permitting): *Chapter 12*

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/.

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:
If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.

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.