

# EGN3353C Fluid Mechanics (With Lab)

## 2021 Summer Syllabus

Lectures: MWF 8-9:15am (online), Lab Th 2-4:45pm (in-person in MAE-C-010)

**Updated 5/9/2021**

*Modifications to this syllabus may be required during the semester.  
Any changes to the syllabus will be posted on the course website and announced in class.*

### Teaching Team

**Instructors:** Matthew J. Traum

Office Hours: Alt. Thursdays 5-6pm (after lab in MAE-C-010) or by appointment (by Zoom)

Email: [mtraum@ufl.edu](mailto:mtraum@ufl.edu)

**Lead ULA &** Cristian Dionisi

**Course PM:** Email: [cristian1928@ufl.edu](mailto:cristian1928@ufl.edu)

**Teaching** Noel Thomas

**Technician:** Email: [noel.thomas@ufl.edu](mailto:noel.thomas@ufl.edu)

### Catalog Description

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

*Prerequisites:* MAC2313 with a minimum grade of C and EGM2511 and (EML3100 or EML3007 or BME3060)

### Course Materials and Fees

Course Fee: \$0

### Course Objectives & Relation to Program Outcomes (ABET)

Students who successfully complete this course demonstrate the following outcomes in the context of engineering fluid mechanics theory and application:

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 covered or assessed in the course.

## Required Textbook

Multimedia Engineering Fluid Mechanics, C. C. Ngo and K. C. Gramol, University of Oklahoma Engineering Media Lab, 2019.

Free OER Access: <http://www.ecourses.ou.edu/cgi-bin/ebook.cgi?doc=&topic=fl>

## Recommended Materials

Introduction to Error Analysis, the Study of Uncertainties in Physical Measurements, 2<sup>nd</sup> Edition, J. R. Taylor, University Science Books, Sausalito, CA, 1997.

## Evaluation of Grades

This course is graded. Grades are earned based on the following individual and group deliverables. Further descriptions will be given when assignments and assessments are announced in class. Additional resources supporting these assignments will be posted on the course Learning Management System as needed.

Assignment/Assessment	Type	Points	%
Participation	Individual	6	2.0
Entry Resume	Individual	1	0.3
Entry Resume Worded Score	Individual	1	0.3
Project Preliminary Presentation	Group	20	6.7
Project Preliminary Peer Evaluation	Individual	0	var.
HW #1: Similarity & Uncertainty	Individual	10	3.3
HW #2: Fluid Properties & External Flow	Individual	10	3.3
HW #3: Hydrostatics	Individual	10	3.3
HW #4: Reynolds Transport Theorem	Individual	10	3.3
HW #5: Pipe Flow, Major & Minor Losses	Individual	Low Drop	N/A
Lab #1: Buckingham Pi & Similarity Report	Group	8	2.7
Lab #2: Uncertainty & Mass Conservation Report	Group	8	2.7
Lab #3: Flow Visualization - Free Jet Report	Group	8	2.7
Lab #4: Fluid Properties - Viscosity Report	Group	8	2.7
Lab #5: External Flow Report	Group	8	2.7
Lab #6: Hydrostatic Standpipe Report	Group	8	2.7
Lab #7: Torricelli Fountain Report	Group	8	2.7
Lab #8: Bernoulli Drain Report	Group	8	2.7
Lab #9: Pipe Flow Velocity Profile Report	Group	8	2.7
Lab #10: Major Losses & Minor Losses Report	Group	Low Drop	N/A
Midterm Exam	Individual	40	13.3
Final Exam	Individual	80	26.7
Project Final Presentation	Group	40	13.3
Project Final Peer Evaluation	Individual	0	var.
<b>TOTAL</b>		<b>300</b>	<b>100.0</b>

*Any changes will be posted on the CANVAS page and announced in class*

### *Explanation of Peer Evaluation:*

All group members will submit feedback reflecting on their own contributions and the contributions their group members to major team deliverables. Evaluations submitted with every group member having perfect scores will be discarded as attempted grade inflation (see honor code section of the syllabus). Peer reviews resulting in

a team member's score being above the class average add 10% to that individual's score on the group deliverable. Peer reviews resulting in a team member's score being within one standard deviation of the class average add 5% to that individual's score on the group deliverable. Peer reviews resulting in a team member's score being within two standard deviations of the class average have no impact on that individual's score on the group deliverable. Peer reviews resulting in a team member's score being more than two standard deviations below the class average subtract 10% from that individual's score on the group deliverable.

### **Grading Policy**

A: 93-100	A-: 90-92.99
B+: 87-89.99	B: 83-87.99
B-: 80-82.99	C+: 77-79.99
C: 73-76.99	C-: 70-72.99
D+: 67-69.99	D: 63-66.99
D-: 60-62.99	E: 0-59.99

More information on UF grading policy may be found at:

<https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/>

### ***Grade Definitions***

- A : Student demonstrated course mastery in all regards and with distinction.
- A- : Student performed outstandingly in all regards and is exceptional.
- B+ : Student performed with excellence in the course.
- B : Student showed high command of course content.
- B- : Student has done a commendable job with course content.
- C+ : Student demonstrated ample grasp of course content.
- C : Student demonstrated adequate grasp of course content.
- C- : Student demonstrated fair grasp of course content.
- D+ : Student met fair course expectations.
- D : Student attained below average expectations.
- D- : Student met minimal expectations to pass.
- E : Student failed to meet minimal expectations to pass.

### **Attendance**

While attendance is not strictly monitored, it is extremely important to attend class regularly. If you miss a class, you are responsible for acquiring notes or other resources covered. The teaching team will endeavor to make all course materials available through the Learning Management System. However, some experiences cannot be replicated asynchronously. Students are held responsible for knowledge of all scheduling and policy announcements made in class. Excused absences must be consistent with university policies in the undergraduate catalog (<https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>) and require appropriate documentation and advance communication with the instructor.

### **Online Course Recording & Copyright Policy**

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 unmute 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. Unless stated otherwise, Dr. Matthew J. Traum holds copyright to all course material.

## **Policies on “Ghosting”, Sources of Truth, and Assignment Grade Disputes**

1. Individuals who fail to support their group or “ghost” the course, as demonstrated by peer evaluation scores two standard deviations below the class average and/or low participation tracked in Canvas/Zoom, earn a failing grade in EGN3353C regardless of points accumulated in the class.

2. Online platforms, notably GroupMe, provide venues for course discussion that exclude the instructor and EGN3353C Teaching Team. Discussion platforms beyond UF-sanctioned Learning Management Systems will not be monitored or curated by the instructor. Thus, information propagated through these platforms can be incorrect. It is each student’s responsibility to verify information obtained from these external discussion services with reputable reference sources or UF-affiliated subject matter experts. Erroneous information obtained from external discussion platforms used in EGN3353C will be marked incorrect on graded assignments and assessments.

3. If an individual or group has an assignment grading dispute, the issue must first be addressed with the Learning Assistant who did the grading. If individuals/groups can show where grading errors occurred, Teaching Team members are happy to correct grades accordingly. Only after communication with a Learning Assistant fails to resolve a grading dispute may the individual/group bring the dispute to the instructor.

## **Students Requiring Accommodations**

Students with disabilities requesting accommodations should first register with the Disability Resource Center [(352) 392-8565, <https://disability.ufl.edu/students/get-started/>] 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 <http://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and they can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <http://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <http://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 ( <http://sccr.dso.ufl.edu/process/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.

## **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](mailto:rbielling@eng.ufl.edu)
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, [taylor@eng.ufl.edu](mailto:taylor@eng.ufl.edu)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, [nishida@eng.ufl.edu](mailto: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 Health, Wellness, and Academic Resources**

See appended page.

### **Schedule of Topics, Assignments, & Assessments**

See appended schedule.

**“Nature always tends to act in the simplest way.”**

--D. Bernoulli

## ***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](mailto: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](mailto: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://www.dso.ufl.edu/documents/UF\\_Complaints\\_policy.pdf](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).

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

Module	Meeting #	Week #	Date	Day	Location	Synchronous Content	Asynchronous Content	Reading	Deliverable Assigned	Assessment / Assignment Due
#1 Experimental Techniques	1	1	5/10/2021	M	Virtual Classroom	1. Course Introduction 2. Buckingham Pi & Similarity	Review of Syllabus & Expectations	1. Ngo & Gramol (2019) Chapter 6: Modeling and Similitude 2. Taylor (1997) Chapter 2: How to Report and Use Uncertainties	1. Resume 2. Resume Worded 3. Project Preliminary Presentations	1. Resume 2. Resume Worded
#1 Experimental Techniques	2	1	5/12/2021	W	Virtual Classroom	Problem Solving Session: Buckingham Pi	Teaching Team Intro Videos			
#1 Experimental Techniques	3	1	5/13/2021	TH	Lab: MAE-C-010	1. Laboratory Safety 2. Buckingham Pi & Similarity Lab			10. Buckingham Pi & Similarity Lab Report	
#1 Experimental Techniques	4	1	5/14/2021	F	Virtual Classroom	Buckingham Pi & Similarity Lab Discussion				
#1 Experimental Techniques	5	2	5/17/2021	M	Virtual Classroom	Experimental Uncertainty		1. Taylor (1997) Chapter 3: Propagation of Uncertainties 2. Pythagoras Cup (Greedy Cup) filled with Mercury <a href="https://youtu.be/ISHT3B4y6E">https://youtu.be/ISHT3B4y6E</a>	5. HW #1: Similarity & Uncertainty	
#1 Experimental Techniques	6	2	5/19/2021	W	Virtual Classroom	Problem Solving Session: Uncertainty	Experimental Uncertainty			10. Buckingham Pi & Similarity Lab Report
#1 Experimental Techniques	7	2	5/20/2021	TH	Lab: MAE-C-010	Uncertainty & Mass Conservation Lab			11. Uncertainty & Mass Conservation Lab Report	
#1 Experimental Techniques	8	2	5/21/2021	F	Virtual Classroom	Uncertainty & Mass Conservation Lab Discussion				
#2 Fluid Properties	9	3	5/24/2021	M	Virtual Classroom	Fluid Properties		1. Understanding Laminar and Turbulent Flow: <a href="https://youtu.be/9A-uUGOWR0w">https://youtu.be/9A-uUGOWR0w</a> 2. Vortex formation in free jet caused by Kelvin-Helmholtz instability <a href="https://youtu.be/ELaZ2v42dU">https://youtu.be/ELaZ2v42dU</a>		
#2 Fluid Properties	10	3	5/26/2021	W	Virtual Classroom	Problem Solving Session: Jet Flow	Fluid Properties			5. HW #1: Similarity & Uncertainty 11. Uncertainty & Mass Conservation Lab Report
#2 Fluid Properties	11	3	5/27/2021	TH	Lab: MAE-C-010	Flow Visualization - Free Jet			12. Flow Visualization - Free Jet Lab Report	
#2 Fluid Properties	12	3	5/28/2021	F	Virtual Classroom	Flow Visualization - Free Jet Lab Discussion				
Memorial Day Observed		4	5/31/2021	M						
#2 Fluid Properties	13	4	6/2/2021	W	Virtual Classroom	Viscosity		Ngo & Gramol (2019) Chapter 1: Basics	6. HW #2: Fluid Properties & External Flow	12. Flow Visualization - Free Jet Lab Report
#2 Fluid Properties	14	4	6/3/2021	TH	Lab: MAE-C-010	Fluid Properties - Viscosity	Couette Flow		13. Fluid Properties - Viscosity Lab Report	
#2 Fluid Properties	15	4	6/4/2021	F	Virtual Classroom	Fluid Properties - Viscosity Lab Discussion				
#3 External Flow	16	5	6/7/2021	M	Virtual Classroom	External Flow		Ngo & Gramol (2019) Chapter 9: External Flow	4. Project Preliminary Peer Evaluations	
#3 External Flow	17	5	6/9/2021	W	Virtual Classroom	Problem Solving Session: External Flow	Drag & Lift on Airfoils, Aircraft Stall			6. HW #2: Fluid Properties & External Flow 13. Fluid Properties - Viscosity Lab Report
#3 External Flow	18	5	6/10/2021	TH	Lab: MAE-C-010	External Flow			14. External Flow Lab Report	
#3 External Flow	19	5	6/11/2021	F	Virtual Classroom	External Flow Lab Discussion				
#4 Hydrostatics	20	6	6/14/2021	M	Virtual Classroom	Project Preliminary Presentations		Ngo & Gramol (2019) Chapter 2: Fluid Statics	7. HW #3: Hydrostatics	3. Project Preliminary Presentations
#4 Hydrostatics	21	6	6/16/2021	W	Virtual Classroom	Problem Solving Session: Hydrostatics	Hydrostatics			4. Project Preliminary Peer Evaluations 14. External Flow Lab Report
#4 Hydrostatics	22	6	6/17/2021	TH	Lab: MAE-C-010	Hydrostatic Standpipe			15. Hydrostatic Standpipe Lab Report	
#4 Hydrostatics	23	6	6/19/2021	F	Virtual Classroom	Hydrostatic Standpipe Lab Discussion			22. Project Final Presentation	
Summer Break		N/A	6/21/2021	M						
Summer Break		N/A	6/23/2021	W						
Summer Break		N/A	6/24/2021	TH						
Summer Break		N/A	6/25/2021	F						
#5 Reynolds Transport	24	7	6/28/2021	M	Virtual Classroom	Reynolds Transport Theorem 1				
#5 Reynolds Transport	25	7	6/30/2021	W	Virtual Classroom	Midterm Review	Ideal Gas Law	Ngo & Gramol (2019) Chapter 3: Fluid Kinematics		7. HW #3: Hydrostatics 15. Hydrostatic Standpipe Lab Report
#5 Reynolds Transport	26	7	7/1/2021	TH	Lab: MAE-C-010	Midterm Exam			20. Midterm Exam	20. Midterm Exam
#5 Reynolds Transport	27	7	7/2/2021	F	Virtual Classroom	Reynolds Transport Theorem 2				
Independence Day Observed			7/5/2021	M						
#5 Reynolds Transport	28	8	7/7/2021	W	Virtual Classroom	Reynolds Transport Theorem 3		Ngo & Gramol (2019) Chapter 4: Integral Analysis	8. HW #4: Reynolds Transport Theorem	
#5 Reynolds Transport	29	8	7/8/2021	TH	Lab: MAE-C-010	Torricelli Fountain	Bernoulli's Equations		16. Torricelli Fountain Lab Report	
#5 Reynolds Transport	30	8	7/9/2021	F	Virtual Classroom	Torricelli Fountain Lab Discussion				
#5 Reynolds Transport	31	9	7/12/2021	M	Virtual Classroom	Unsteady Bernoulli				
#5 Reynolds Transport	32	9	7/14/2021	W	Virtual Classroom	Problem Solving Session: Bernoulli Equation	Navier-Stokes Equations	Ngo & Gramol (2019) Chapter 5: Differential Analysis		8. HW #4: Reynolds Transport Theorem 16. Torricelli Fountain Lab Report
#5 Reynolds Transport	33	9	7/15/2021	TH	Lab: MAE-C-010	Bernoulli Drain			17. Bernoulli Drain Lab Report	
#5 Reynolds Transport	34	9	7/16/2021	F	Virtual Classroom	Bernoulli Drain Lab Discussion				
#6 Internal Flow	35	10	7/19/2021	M	Virtual Classroom	Pipe Flow 1		Ngo & Gramol (2019) Chapter 7: Incompressible and Inviscid Flow	9. HW #5: Pipe Flow, Major & Minor Losses	
#6 Internal Flow	36	10	7/21/2021	W	Virtual Classroom	Problem Solving Session: Pipe Flow	Minor Losses & Flow Metering			17. Bernoulli Drain Lab Report
#6 Internal Flow	37	10	7/22/2021	TH	Lab: MAE-C-010	Pipe Flow Velocity Profile			18. Pipe Flow Velocity Profile Lab Report	
#6 Internal Flow	38	10	7/23/2021	F	Virtual Classroom	Pipe Flow Velocity Profile Lab Discussion				
#6 Internal Flow	39	11	7/26/2021	M	Virtual Classroom	Pipe Flow 2		Ngo & Gramol (2019) Chapter 8: incompressible and Viscous Flow		
#6 Internal Flow	40	11	7/28/2021	W	Virtual Classroom	Problem Solving Session: Major & Minor Losses	Energy Equation & Head Loss			9. HW #5: Pipe Flow, Major & Minor Losses 18. Pipe Flow Velocity Profile Lab Report
#6 Internal Flow	41	11	7/29/2021	TH	Lab: MAE-C-010	Major & Minor Losses			19. Major Losses & Minor Losses Lab Report	
#6 Internal Flow	42	11	7/30/2021	F	Virtual Classroom	Major & Minor Losses Discussion				
#7 Compressible Flow	43	12	8/2/2021	M	Virtual Classroom	Compressible Flow 1		Compressible Flow Chapter	23. Project Final Peer Evaluations	
#7 Compressible Flow	44	12	8/4/2021	W	Virtual Classroom	Compressible Flow 2	Compressible Flow			19. Major Losses & Minor Losses Lab Report
#8 Final Deliverables	45	12	8/5/2021	TH	Lab: MAE-C-010	Final Exam			21. Final Exam	21. Final Exam
#8 Final Deliverables	46	12	8/6/2021	F	Virtual Classroom	Final Project Presentations				22. Final Project Presentations 23. Project Final Peer Evaluations