

Hydrodynamics

CWR 3201

Class Periods: TR 5-6, Labs MTWRF 8-9

Location: Lecture 0018 MAT; Lab 254 Weil

Academic Term: Spring 2022

Instructor:

Dr. Robert J. Thieke

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294-7783

Office Hours: TR 9:45 a.m. – 11:15 a.m. 370B Weil Hall

Teaching Assistants: TBA

Course Description

Classification and properties of fluids, hydrostatics, and conservation of mass, momentum and energy in fluid flow. Potential flow, similitude and physical modeling. Laminar and turbulent pipe flow. Introduces turbomachines.

4 Credit Hours

Course Pre-Requisites / Co-Requisites

EGM 3400 and MAP 2302

Course Objectives

The specific objectives of the course include the ability to:

- Identify and explain each of the general properties of fluids and demonstrate how each is significant in various fluid flow applications.
- Calculate pressure distributions in a static fluid, evaluate the resulting forces on solid surfaces, and determine the effects of those forces in a given system.
- Identify the key components of mechanical energy in flowing fluid and examine their variation along typical incompressible pipe and channel flows.
- Apply mass and momentum conservation equations to solve for velocity, elevation, pressure and forces in pipe and channel flows given the other variables.
- Apply potential flow solutions to solve basic practical shallow water and groundwater engineering flow problems.
- Employ dimensional analysis methods to design a scale model to replicate a given prototype flow system.
- Formulate a complete empirical solution for resistance in turbulent, incompressible pipe flow.
- Select and size pipes to design a single pipe system to meet head and flow constraints.
- Evaluate and optimize simple pipe system designs including pumps and turbines.
- Perform laboratory experiments to reinforce physical principles and develop and refine the student's physical intuition.

Materials and Supply Fees

None

Professional Component (ABET):

As the first of a required three course sequence in Water Resources Engineering (Hydrodynamics, Hydraulics, Wastewater Treatment), CWR 3201 is one of the basic civil engineering courses satisfying the need for 1.5 years of engineering coursework and also provides the foundation for design courses that follow (such as Urban Stormwater Management).

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	
3. an ability to communicate effectively with a range of audiences	High
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	Low
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	High
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	Medium

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

Required Textbooks and Software

- *A Brief Introduction to Fluid Mechanics*
- Young, Munson, Okiishi and Huebsch
- 5th Edition, 2011
- ISBN 978-0470-59679-1

Recommended Materials

Formal class notes for the entire course (in "framework" style, with important equations, words, diagrams, etc. omitted) are available for purchase at Target Copy, 1412 W University Avenue (376-3826), and will be needed after the first day of class. These will be very useful for reviewing the recorded lectures.

Course Schedule

Week 1:	Introduction, Fluid Properties	Chapter 1
Week 2:	Fluid Properties	Chapter 1
Week 3:	Fluid Statics	Chapter 2
Week 4:	Fluid Statics	Chapter 2
Week 5:	Bernoulli Equation	Chapter 3
Week 6:	Bernoulli Equation	Chapter 3
Week 7:	Kinematics, Exam 1	Chapter 4
Week 8:	Linear Momentum Equation	Chapter 5
Week 9:	Energy Equation	Chapter 5
Week 10:	Viscous Flow	Chapter 6
Week 11:	Potential Flow, Exam 2	Chapter 6
Week 12:	Dimensional Analysis	Chapter 7
Week 13:	Scale Models, Pipe Flow	Chapter 7, 8
Week 14:	Pipe Flow	Chapter 8
Week 15:	Pipe Flow, Pumps	Chapter 8, 11
Week 16:	Review, Exam #3	-----

Attendance Policy, Class Expectations, and Make-Up Policy

This class will be presented in a “flipped” format as opposed to a standard lecture-style class. In this approach, the expectation is that students will watch video lectures in preparation to attending the class meetings. Traditional homework will not be assigned in favor of in-class problems, case studies, and other practical examples of engineering and every-day fluid mechanics. In this manner there are three steps for reinforcement of important concepts to aid in long-term understanding:

- 1) Review of recorded lectures and completion of “framework” style notes;
- 2) Completion of class activities and quizzes; and
- 3) Review for examinations.

As such, attendance in class is essential to success in this course. Individual and team quizzes will review material from the recorded lectures in order to assure that all students have come prepared for the activities of the day. Additional quizzes will be given at class meetings that will also serve as attendance credit. Attendance at laboratory sections is mandatory.

Excused absences are consistent with university policies in the undergraduate catalog: (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and require appropriate documentation.

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Exam 1	100	15%
Exam 2	100	15%
Exam 3	100	20%
Laboratory Reports	10 each	25%
Quizzes (individual)	40 each	10%
Quizzes (Team)	40 each	10%
Ethics Paper	5	3%
Attendance		2%

Grading Policy

The following is given as an example only.

Percent	Grade	Grade Points
93.0 - 100	A	4.00
90.0 - 92.9	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 - 76.9	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:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

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 feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu/evals>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students via a link on the same page.

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>

Diversity Statement

The Herbert Wertheim College of Engineering (HWCOE) values a diverse and inclusive community. It is integral to success in every area of our college. Therefore, the College is committed to non-discrimination with respect to all areas of human differences, including but not limited to national and ethnic origin, race, age, sex, sexual orientation, gender identity and expression, beliefs and opinions, religion and faiths, culture, socio-economic background, level of physical or mental ability, and veteran’s status. This commitment applies in all areas – to students, faculty, and staff and intends to reflect the College’s belief that educational and employment decisions and access to University activities should be based on an individual’s abilities and qualifications.

The HWCOE values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. We aspire to educate students to become future leaders capable of creating diverse and inclusive work cultures wherever their careers may take them.

Online Course Recording:

Our class sessions may be audio and visually recorded for students in the class who are unable to attend live. Students who participate by asking questions in class are agreeing to have their voice recorded. In the event that we have to revert to full class meetings via Zoom, students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. In this case, 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. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

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.

Health and Wellness:

You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated. Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.

If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email covid@shcc.ufl.edu) to be evaluated for testing and to receive further instructions about returning to campus. UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the UF Health Screen, Test & Protect website for more information.

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 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>.