



University of California, Merced

ENGR 120

Fluid Mechanics

Fall 2021

Synopsis: This is intended as a first course in fluid mechanics, and includes an Introduction to fluid properties, fluid statics, conservation of mass, energy and momentum, and internal and external flow. Topics include hydrostatic pressure, hydraulic head, friction losses, laminar and turbulent flow, pipe flow, open-channel flow, flow through porous media, and dimensional analysis.

Student Learning Objectives: Students completing this course will understand basic fluid mechanics, including fluid properties, fluid statics, the origin of conservation of mass, energy and momentum equations and their application to a range of internal and external flow problems, and laminar and turbulent flow conditions. They will also acquire an introductory knowledge of dimensional analysis, open-channel flow, and flow through porous media. Finally, students will gain experience and skills in with experimentation and data analysis for fluidic systems and creating simple designs for fluidic components and systems.

More specifically, upon completion of this course students will be:

- Able to perform unit conversions related to basic fluid properties, fluid statics, and fluid dynamics.
- Able to analyze hydrostatic forces and moments on submerged and partially submerged surfaces.
- Able to construct an appropriate control volume for a given engineering system and apply the conservation principles of mass, momentum, and/or energy to the control volume.
- Ability to apply differential analysis to the conservation principles of mass, momentum, and/or energy to describe flow characteristics in a flow field.
- Apply dimensional analysis to determine appropriate dimensionless parameters and use the parameters for scaling and other model/prototype problems.
- Able to analyze steady-state flow problems in pipes and open-channel flow and specify appropriately sized components for a fluid flow system.
- Able to define terms associated with external incompressible flows such as drag, lift, friction and how to estimate these values.
- Able to design and conduct experiments, analyze data, and communicate results in written and oral technical reports.
- Familiar with conception and documentation of the design of simple fluidic systems (e.g., pumps and piping, etc.).

Learning Outcomes

This course will help students attain the following learning outcomes required by the Accreditation Board for Engineering and Technology (ABET):

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
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.
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.

Prerequisites: ENGR 057 and MATH 024 (can be taken concurrently)

Faculty Instructor: Robert Rice, School of Engineering, Department of Civil and Environmental Engineering, SE2 375.

Office Hours: **Tuesday 4:30 – 6:00PM, SE2 Lobby** or by appointment (rrice@ucmerced.edu).
Don't hesitate to email me and the TA---often confusion can be cleared up quickly, and without waiting for office hours!

Teaching Assistant:

Marc Labata (mlabata@ucmerced.edu)

TA Office Hours: Monday, 1:00 – 2:30PM, SRE, 3rd floor lobby

In-class Lectures: Tuesday/Thursday 9:00 – 10:15 AM, COB1 270. Attendance mandatory.

Lab: Wednesday (02L): 1:30 – 4:20PM (Marc Labata), SE2 150. Attendance mandatory

Textbooks and Supplementary Reading Materials: Readings will be assigned on a regular basis from the required textbook listed below and from class handouts (see schedule). These readings will be supplemented by class notes distributed at the lectures and available on the website. The following textbook is required and is available for purchase at the campus bookstore:

Fundamentals of Fluid Mechanics, 8th Edition, Munson, Young, Okiishi and Huebsch, 9th edition, ISBN 9781118116135, Wiley (2013).

Course Web Site: Course information, including the semester schedule for lecture slides, some handouts, and all assignments and their due dates, is available at the course web site. You can access the course site through Cat Courses: <https://canvas.ucmerced.edu/courses/21334>.

Course Workload & Grading

Grading: The course grade is determined by performance on problems sets, examinations, and lab reports. Note that attendance is highly recommended for lectures, and mandatory for lab sections. Grades are distributed as follows:

<u>Work Product</u>	<u>Points</u>	
Problem sets	10%	(10 sets, drop lowest score)
Reading/Lecture Quizzes	5%	(Drop lowest score)
Labs	15%	(6 Labs, drop lowest score)
Exam 1	15%	
Exam 2	15%	
Exam 3	15%	
Final Exam	25%	
Total	100%	

3 exams -- see lecture schedule: subject to change with lecture pace, etc.

Final exam - 3:00 – 6:00 PM Tuesday, December 14.

All examinations for this course will be r short fundamental questions, and (primarily) problems to solve. The examinations will be designed to test knowledge of concepts and definitions important to an understanding of fluid mechanics, and problem-solving skills. Questions on these topics will be drawn from the material presented in lecture and from the homework assignments.

Problem sets (homework assignments) are due on roughly a weekly basis (due dates will be clearly indicated on the assignment). You are strongly encouraged to try the homework on your own first, but you can work together with other students (please make sure you are doing your part to understand the material, or you will likely have difficulties with the exams!). *These assignments must be completed in a professional manner on engineering paper (neat/legible, with work process and logic made clear), and will be graded on appearance, effort, and correctness of approach (grading rubric will be provided).* There will be 10 problems sets, and you will be allowed to drop your lowest score. **Note, homework problem sets will not be graded if not completed on engineering paper.** Problem sets/homework assignments are submitted online via Cat Courses as a PDF.

Labs grades will be based on attendance and participation in the lab, and on the lab report (due 1 week after your lab). The format for lab reports will be provided at the time of the lab (grading rubric will be provided). There will be 6 labs, worth 10 points each, and you will be allowed to drop your lowest score. **You must complete 5 of 6 labs with a cumulative lab average of 70% in order to pass the course.**

Policy on late assignments: Late assignments will not be accepted. Sorry for the need to be strict about this, but it becomes difficult to manage all the assignments.

A UNIVERSITY POLICIES

Academic Integrity

Scholastic dishonesty is a serious offence and will not be tolerated. Students are expected to complete their own work and to abide by the UC Merced Academic Honesty Policy, which can be found on the Student Conduct website: <http://studentconduct.ucmerced.edu/>. Any work submitted by a student in this course for academic credit will be the student's own work.

You are encouraged to study together and to discuss information and concepts covered in lecture and the sections with other students. You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else, (for example) in the form of an email, an email attachment file, an online file in a shared folder, a diskette or external drive, or a hard copy. Should copying occur, both the student who copied work from another student and the student who gave material to be copied will both automatically receive a zero for the assignment. Penalty for violation of this Policy can also be extended to include failure of the course and University disciplinary action.

You must do your own work during *examinations and quizzes*. Talking or discussion is not permitted during the examinations and quizzes, nor may you compare papers, copy from others, or collaborate in any way. Any collaborative behavior during the examinations or quizzes will result in failure of the exam and may lead to failure of the course and University disciplinary action.

Note that the handouts and notes provided in this course are for your *personal* use only. Re-posting such materials on other sites is an explicit violation of this agreement. Students are also not permitted to record and distribute the lectures.

Students and instructors are expected to honor UC Merced's Founding Principles of Community: <http://www.ucmerced.edu/about-uc-merced/principles-community>

Student Accessibility Services

University of California, Merced is committed to creating learning environments that are accessible to all. If you anticipate or experience physical or academic barriers based on a disability, please feel welcome to contact me privately so we can discuss options. In addition, please contact Student Accessibility Services (SAS) at (209) 228-6996 or disabilityservices@ucmerced.edu as soon as possible to explore reasonable accommodations. All accommodations must have prior approval from Student Accessibility Services on the basis of appropriate documentation. <https://disabilityservices.ucmerced.edu/>

If you anticipate or experience barriers due to pregnancy, temporary medical condition, or injury, please feel welcome to contact me so we can discuss options. You are encouraged to contact the Dean of Students for support and resources at (209) 228-3633 or <https://studentaffairs.ucmerced.edu/dean-students>

Dropping and Adding

Students are responsible for understanding the policies and procedures about add/drops, academic renewal, etc. Students should be aware of the new deadlines and penalties for adding and dropping classes. <http://registrar.ucmerced.edu/policies/adddropwithdraw>

CAMPUS RESOURCES

CARE Office

Although faculty and staff members can act as excellent resources for students, they are mandated to report any violations of campus policy. Because of this, students may want to utilize the Confidential CARE Advocate on campus for support related to counseling or sensitive issues. Campus Advocacy, Resources, & Education (CARE) provides prevention education for the UC Merced community to achieve an environment free from the threat of sexual violence, dating/domestic violence, and stalking. They provide free and confidential assistance for all UC Merced affiliates (including Undergraduate students, Graduate students, Staff and Faculty). Stop by KL 107. <https://care.ucmerced.edu/>

Contact Information (Confidential Help)

Campus Advocate: (209) 386-2051 | Valley Crisis Center: 24/7 Hotline (209) 722-HELP (4357)

Counseling and Psychological Services (CAPS)

The mission of UC Merced Counseling and Psychological Services (CAPS) is to support the mental health and well-being of our students. It is the intention of all CAPS staff to provide a safe, confidential atmosphere of acceptance and accessibility to professionals in the field of psychology.

Contact Information

UC Merced H. Rajender Reddy Health Center

Phone: (209) 228-4266 (8AM-4:30PM M-F)

counseling@ucmerced.edu, <https://counseling.ucmerced.edu/>

Urgent Services

After-Hours Crisis Line: (209) 228-4266, option 1

Campus Police (209) 228-2677

National Suicide Hotline (800) 273-8255

National Service Crisis Text Line (confidential) Text 'Start' to 741-741

Call 911

Office for the Prevention of Harassment and Discrimination

The University of California is committed to creating and maintaining a community where all individuals who participate in university programs and activities can work and learn together in an environment free of harassment, exploitation, or intimidation. At this website, students will find sexual violence and discrimination resources and ways to officially report harassment and discrimination. <https://dsvp.ucmerced.edu/>

Basic Needs Security

With the growing number of students suffering from food, housing, and financial insecurities, the Basic Needs Security team at UC Merced is committed to providing resources and program to help. They provide resources for financial, food, housing, and transportation security as well as mental wellness. Please visit their website for more details: <https://basicneeds.ucmerced.edu/>

Center for Career & Professional Advancement <https://hire.ucmerced.edu/>

The instructor highly recommends that you visit the career center if you have not already to create and get feedback on your resume, search for summer internship opportunities, and get general career advice. Graduation will come soon, and many times employers want students with experience which requires professional internships. Also, the career center has a **clothing closet** if you need to borrow professional clothes for the course final presentation or interviews.

<https://hire.ucmerced.edu/professional-clothing-closet>

Dean of Students/Student Affairs

Utilizing a social justice orientation rooted in community cultural wealth, criticalness, collaboration, accountability, and care, the Office of the Associate Vice Chancellor and Dean of Students is a central space for students, parents, staff, and faculty to receive assistance with navigating the complexity of student life. Help students navigate the university system, supports student success, serves as a student advocate, and allows professors to report students of concern that may be missing class or experiencing other difficulties. You can request an appointment with a representative in the Dean of Students Office: <https://studentaffairs.ucmerced.edu/dean-students>

Office of the Ombuds

The Office of the Ombuds is a safe place where UC Merced community members can go for informal assistance with managing conflict, complaints, and concerns with a colleague, classmate, supervisor or anyone else on campus. Use of our office is always voluntary and talking with an ombuds person does not constitute notice to the university for formal complaint. We operate under the *International Ombuds Association's (IOA) ethical principles of confidentiality, neutrality, informality and independence.* <https://ombuds.ucmerced.edu/>

Other

There are many other campus resources for students including:

- Student Health Services: <https://health.ucmerced.edu/>
- PALs tutoring: <https://learning.ucmerced.edu/programs/tutoring>
- STEM center: <https://stemresourcecenter.ucmerced.edu/>
- Writing center: <https://writingcenter.ucmerced.edu/>
- Library: <http://library.ucmerced.edu/>. Student groups will be required to meet with a librarian for their group projects: <http://libcal.ucmerced.edu/appointments/#>
- Services for undocumented students: <https://undoc.ucmerced.edu/>
- LGBTQ+ Programs: <http://lgbtq.ucmerced.edu/>
- Women's Programs: <https://womensprograms.ucmerced.edu/>

If I have missed any resources or you feel they should be greater explained in the syllabus, let the instructor know.

Religious/Cultural Observance

Persons who have religious or cultural observances that coincide with this class should let the instructor know in writing (by e-mail for example) at least a week before the missed class. I strongly encourage you to honor your cultural and religious holidays! However, if I do not hear from you before class, I will assume that you plan to attend all class meetings.