

University of Colorado Denver
Department of Civil Engineering
CVEN-3313 Fluid Mechanics

Fall 2021

Lecture: Mon/Wed 2:00-3:15 pm

Location: North Classroom 1005

Office Hours: Mon/Wed 3:30-4:45 pm,
and by appointment

Instructor: David C. Mays, P.E., Ph.D.

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<http://engineering.ucdenver.edu/dmays/3313>

Catalog Description: Fundamentals of fluid mechanics. Topics include fluid properties, hydrostatics, the continuity principle, the energy principle, the momentum principle, similitude and dimensional analysis, drag, and friction for laminar and turbulent flow in closed conduits. *Prerequisite:* CVEN-2121, Analytical Mechanics I (Statics)

Course Objectives: At the end of the semester, you should be able to:

1. Identify the key parameters used to describe fluids.
2. Calculate resultant forces (like you did in statics) caused by hydrostatic pressures.
3. Analyze flow rates, fluid velocities, pipe sizes, or channel depths from continuity.
4. Calculate power consumption by pumps and power generation by turbines.
5. Design single-pipe systems using Bernoulli's equation and concepts of pipe roughness.

Required Text: Song, H. (2018), *Engineering Fluid Mechanics*, Springer, Singapore, <https://doi.org/10.1007/978-981-13-0173-5>. From an on-campus computer, you should download a free PDF or EPUB. If desired, you can order a printed hard copy for your library (softcover \$24.99).

| Week | Dates | Topic | Reading Assignment* |
|------|--------------|---|---------------------------------------|
| 1 | 8/23, 8/25 | Properties of Fluids | §1.1-1.3, <i>F/F-2002 §2.9, §2.13</i> |
| 2 | 8/30, 9/1 | Hydrostatics: Manometers | §2.1-2.4 |
| 3 | 9/6, 9/8 | Hydrostatics: Resultants | §2.5 |
| 4 | 9/13, 9/15 | Hydrostatics: Buoyancy | <i>F/F-2002 §3.8-3.10</i> |
| 5 | 9/20, 9/22 | Basics of Fluid Flow | §3.1-3.3 |
| 6 | 9/27, 9/29 | Energy Equation I (EXAM #1) | §3.5-3.6 |
| 7 | 10/4, 10/6 | Energy Equation II | §3.7-3.8 |
| 8 | 10/11, 10/13 | Power and Efficiency | <i>F/F-2002 §5.9-5.10, §5.16-5.18</i> |
| 9 | 10/18, 10/20 | Hydrodynamics: Forces | §3.4, §3.9 |
| 10 | 10/25, 10/27 | Similitude | §8.1 |
| 11 | 11/1, 11/3 | Dimensional Analysis (EXAM #2) | §8.2 |
| 12 | 11/8, 11/10 | Drag | <i>F/F-2002 §9.1-9.8</i> |
| 13 | 11/15, 11/17 | Pipe Flow: Darcy-Weisbach | §4.1-4.4 |
| 14 | 11/29, 12/1 | Pipe Flow: Moody-Stanton | §4.5-4.6 |
| 15 | 12/6, 12/8 | FE Exam and Review | |

* Except as noted, all reading assignments are from Song (2018). Reading assignments from Finnemore and Franzini (2002), indicated in *bold italics* as F/F-2002, will be provided on the public website <http://engineering.ucdenver.edu/dmays/3313>.

Midterms: Monday 9/27/2021 (weeks 1-4), Monday 11/1/2021 (weeks 1-9).

Final Exam: To be scheduled during exam week: Monday 12/13/2021 to Friday 12/17/2021.

Grades: 20% homework, 20% each midterm, 35% final exam, 5% participation.

Homework

Homework will be assigned in class each Monday or through the “Assignments and Answers” link on the course website, and will be due in class Wednesday of the next week. Engineering paper is strongly encouraged but not required. To clarify the presentation, accelerate the grading, and develop attention to detail, homework must comply with the following specifications:

1. At the top of *each* page, write your name, class number, homework number, due date, and page of total (1 of 5, 2 of 5, etc.). Submitting late? OK, but write the date submitted on the first page.
2. Draw a picture for *each* problem. Use a straight edge for straight lines.
3. Briefly restate *each* problem in your own words. Do not copy the problem statement verbatim.
4. State what you are going to calculate under heading FIND.
5. State any relevant assumptions, including assumed precision of input numbers.
6. Write the units for all numbers, not just final results:
 - a. Use the same units (metric or US) as the problem.
 - b. Write 5 ft rather than 5' and 8 in rather than 8".
 - c. Units like psi are fine for results, but otherwise write lb/in² to show unit cancellation.
7. Write each result, with the correct number of significant digits, on its own line.

Homework grades are A (100%), B (85%), C (75%), D (65%), and F (0%). Homework will be graded for presentation, approach, correctness, and compliance with the specifications.

- Life happens, so late homework is accepted—no questions asked—with a penalty of one letter grade per class.
- Late homework not stating the date submitted will be penalized by one letter grade.
- No credit for late assignments after solutions have been posted online.

Participation

Rationale for participation grade: Learning is an activity that we perform (like dancing, fixing cars, or skiing) rather than a commodity that we purchase. I will attempt to call on each of you each week, and I expect you to reply every time. Why? Because you are training to become a professional, who will be called upon to speak up and answer technical questions. People will expect you to be prepared. This means you should complete the reading assignment before class. If you make a habit of missing class, your participation grade will suffer.

Communication

I expect you to check your official university e-mail account each and every business day, or forward your e-mail to another account you check each and every business day. For details, see the university website.*

Academic Integrity

Studying with others is useful and encouraged, but you must perform and present your own work, so copied solutions—from an online resource, from a paid tutor, from other students, or from any other source—violate the expectation for academic integrity stated in the *2021-2022 Undergraduate Catalog*

* <http://www.ucdenver.edu/email/>

or *2021-2022 Graduate Catalog*, including the Academic Integrity and Discipline Policies,[†] and the Student Honor Code for the College of Engineering, Design and Computing. Midterm and final exams will be governed by an Exam Policy to be distributed separately. Finally, to avoid plagiarism, cite your sources using American Society of Civil Engineers format.[‡]

General

- Snow Closure Hotline 877-556-3637.
- I am happy to work with anyone needing special accommodations. The university asks students to register with Disability Resources and Services (DRS), who evaluate each situation on a case-by-case basis. I am always more than happy to provide accommodations per your letter from DRS.
- Missed exams will receive an F, except (a) when special arrangements have been made with me ahead of time, or (b) with documentation of an emergency.
- Grades will not include plus or minus designations.
- Syllabus subject to revision.
- Students are responsible for all material presented in class, readings, homework, and e-mail.

Finally, this semester's Academic Calendar and our Student Honor Code are attached below. If you have not done so already, please print, sign, and scan the Student Honor Code and e-mail back to me.

Welcome to the class!

Auraria Campus is located on the original territory of the Cheyenne, Arapahoe, and Ute Nations.

[†] <http://catalog.ucdenver.edu/>

[‡] <http://ascelibrary.org/doi/pdf/10.1061/9780784478998.ch17>

| Main Session | Date | Important Notes |
|--|--------------------|---|
| First day to apply for Fall Graduation via UCDAccess. | April 1, 2021 | |
| Registration begins for Fall Semester via UCDAccess. | April 1 - 16, 2021 | Check UCDAccess for your specific registration date and time assignment. For best course selection, register as soon as possible after your registration time assignment. |
| Open enrollment begins. | April 19, 2021 | |
| First day of Fall semester classes. | August 23, 2021 | |
| Last day to waitlist classes using UCDAccess. | August 29, 2021 | |
| Last day to drop a class without a \$100 drop charge (by 11:59 PM MT). | August 30, 2021 | All waitlists will be eliminated today. |
| First day instructor approval may be required to add some classes. | August 30, 2021 | If unable to enroll in UCDAccess because "Instructor Consent is Required", obtain instructor approval on a Schedule Adjustment Form. |
| Labor Day Holiday. | September 6, 2021 | No classes. Campus closed. |
| Census | September 8, 2021 | |
| Last Day to add classes in UCDAccess. | September 8, 2021 | |
| Last day to add classes with instructor consent on the Schedule Adjustment form. | September 8, 2021 | If unable to enroll in UCDAccess because "Instructor Consent is Required", obtain instructor approval on a Schedule Adjustment Form. |
| Last day to drop classes with a financial adjustment (before 5pm). | September 8, 2021 | |
| Classes dropped after 5pm will appear on your transcript with a grade of "W". | September 8, 2021 | |
| Full tuition will be charged for additional classes added after 5pm. | September 8, 2021 | College Opportunity Fund hours will not be deducted from eligible student's lifetime hours. |
| Last day to apply for Fall graduation via UCDAccess. | September 8, 2021 | After this date, contact your advisor. |
| Last day to request or cancel Grade Forgiveness. | September 8, 2021 | Refer to the Grade Forgiveness form for restrictions. |

Last Updated 1/26/2021

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|--|------------------------------|---|
| Last day to request No Credit or Pass/Fail grade for a class. | October 31, 2021 | Graduate degree students can exercise the P/F option for undergraduate courses only. Graduate students should consult their school or college regarding the P/F option. A grade of P will not be acceptable for graduate credit to satisfy any Graduate School requirement. |
| Last day to withdraw from a class via UCDAccess. | October 31, 2021 | |
| First day to withdraw from a class with a Late Withdraw Petition form. | November 1, 2021 | |
| Registration begins for Spring Semester via UCDAccess. | Nov. 1, 2021 - Nov. 16, 2021 | Check UCDAccess for your specific registration date and time assignment. For best course selection, register as soon as possible after your registration time assignment. |
| Open enrollment begins for Spring Semester. | November 17, 2021 | |
| Fall Break. | November 22 - 28, 2021 | No classes. Campus open. |
| Thanksgiving Day. | November 25, 2021 | No classes. Campus closed. |
| Last day to withdraw from a class with a Late Withdraw Petition form. | December 8, 2021 | |
| Finals week. | December 13 - 18, 2021 | |
| End of semester - Commencement. | December 18, 2021 | |
| Final grades available on UCDAccess and transcripts (tentative). | December 23, 2021 | |
| Winter Break. | Dec. 25, 2021 - Jan. 1, 2022 | No classes. Campus closed. |
| Fall degrees posted on UCDAccess and transcripts (tentative). | January 21, 2022 | This is the date your degree will be recorded on your transcript; diplomas begin mailing on February 9th. |

Important Information

Refer to the Residency website for important deadlines pertaining to In-State Tuition Rate qualification.

Refer to the College Opportunity Fund (COF) website for important deadlines pertaining to the COF stipend for eligible undergraduate students paying in-state tuition.

Additional Billing/Financial Information: Students are responsible for complying with tuition/fees deadlines. All registered students must access their student account and billing information through UCDAccess. You will also receive an electronic bill to your university email account.

Last Updated 1/26/2021



Student Honor Code

(Revised 8/14/2019)

The Honor Code outlined below is the College of Engineering, Design and Computing statement on academic integrity. The Code articulates the College’s expectations of its students and faculty in establishing and maintaining the highest standards in academic work.

Honor Code Text

The Honor Code of the College of Engineering, Design and Computing is a statement of its students, individually and collectively:

- Students will not give or receive aid during examinations.
- Students will not use any prohibited electronic devices during examinations.
- Students will not give or receive unpermitted aid in class work, in the preparation of reports, or in any other work that is to be used by the instructor as the basis of grading.
- Students will uphold the spirit and letter of the Honor Code and they will take an active role to ensure that others uphold the Honor Code and if they observe violations of the Honor Code they must report violations to their Department Chair.
- The Faculty of the College will do its part to ensure its confidence in the honor of its students. Faculty must ensure that precautions are in place to prevent the forms of dishonesty mentioned above. Faculty will also avoid, as far as practical, academic procedures that create temptations to violate the Honor Code. Faculty alone has the right and obligation to set academic requirements. However, the students and faculty will work together to establish optimal conditions for honorable academic work.

Violations of the Honor Code

Examples of conduct that will be regarded as being in violation of the Honor Code include:

- Copying from another’s examination paper or allowing another to copy from one’s own paper.
- Plagiarism in any shape or form. Plagiarism is defined as the use, without giving reasonable and appropriate credit to or acknowledging the author or source, of another person’s original work, whether such work is made up of code, formulas, ideas, language, research, strategies, writing or other form(s).
- Giving or receiving unpermitted aid either in person or via electronic devices.
- Engaging in unauthorized collaboration on academic assignments or examinations.
- Representing as one’s own work the work of another.

Penalties for Violating the Honor Code

Most student disciplinary cases have involved Honor Code violations. Of these, most cases arise when a student submits another’s work as his or her own, gives or receives unpermitted aid, or engages in unauthorized collaboration. If a violation occurs during a quiz or on a homework assignment, the student will receive a zero for that quiz or assignment. If a violation occurs on an examination or project the student will receive a failing grade for the course. The standard penalty for a first offense may include suspension from the College of Engineering, Design and Computing for a severe infraction of the Honor Code. The penalty for a second violation will be expulsion from the College of Engineering, Design and Computing.

It is the responsibility of the student to seek clarification from the instructor when in doubt about these guidelines.

By signing below, I affirm that I have read and understood the Student Honor Code and will abide by its provisions.

Student Name *(printed)*: _____

Student ID: _____

Student Signature: _____

Date: _____