

ME 310
Fundamental Fluid Mechanics AE2/ZJ2
Spring 2024

TIME/PLACE: Lectures: MWF 11:00 am-11:50 am
2055 Sidney Lu Mech Engr Bldg

INSTRUCTOR: Professor Jie Feng
Office: 4421 Mechanical Engineering Laboratory (MEL)
E-mail: jiefeng@illinois.edu (ALWAYS use ME310 in subject line for emails)
Office hours: TBD. I will take questions on a first-come first-serve basis. You can also contact me for extra office hours. TAs will also hold office hours for HW and lab reports.
Website: fenglab.mechse.illinois.edu
Twitter: <https://twitter.com/FengFluidsLab>

COURSE DESCRIPTION: The course introduces the quantitative foundations necessary to characterize the behavior of fluids. The students will familiarize with: 1) the basic definitions and quantities relative to fluids, 2) different mathematical formulations – integral and differential, 3) various flow regimes - very viscous, intermediate, and inviscid, 4) different flow phenomena – pipe and open channel. This theoretical background is complemented by several applications relevant to engineering and science.

COURSE OUTLINE:

1. Fluids Properties (what is a fluid, fundamental quantities, units)
2. Fluid Statics (nothing flows)
3. Flow Kinematics (how to describe a moving fluid)

Mid-term Exam 1

4. Fluid Dynamics: Finite-volume analysis
5. Fluid Dynamics: Differential analysis, constitutive laws
6. Dimensional Analysis and Similitude (getting rid of units)

Mid-term Exam 2

7. Internal Flows (pipe flows)
8. External Flows (boundary layer, lift and drag forces)
9. Compressible Flows (tentatively)

Final Exam

PREREQUISITE Prior credit in MATH 285 or MATH 286 and prior credit or concurrent registration in ME 200 are required. The importance of some degree of dexterity with calculus cannot be overstated. In this context, the material of MATH 241 Calculus III is even more important. If differential equations as well as symbols such as partial derivatives(∂), gradients(∇), divergence($\nabla \times$), or Laplacian(∇^2) do not “ring a bell”, attendance of this course will, sooner or later, become problematic.

LAB: Instructor: Dr. Blake Everett Johnson
Office: 1024 Sidney Lu Mech Engr Bldg
Email: bejohnso@illinois.edu

Detailed information for the laboratory is available at the laboratory Canvas website.

Please address all specific questions concerning the laboratory sections and experiments to Dr. Johnson (see above for contact information)

This course has a separate laboratory section that will help illustrate the concepts presented in class through physical demonstration. Laboratory attendance is required and you may only attend the laboratory section for which you have registered. While you will perform the lab activities as a group, each student must prepare his/her own written report. **Plagiarism of lab reports is a serious ethical violation and will be dealt with using the most stringent available counter-measures.** TAs will be regularly checking for plagiarized reports using an extensive database of reports from previous semesters and sister institutions.

TAs: "Chun, Sung Gyu" <chun7@illinois.edu>, Zhengyu Yang <zhengyu7@illinois.edu>, Vinit Kumar <vinitk2@illinois.edu>, yitew2@illinois.edu, kc63@illinois.edu, rmkhan2@illinois.edu, sl148@illinois.edu, animesh8@illinois.edu, "Nasiriziba, Iliia" ilia2@illinois.edu

LECTURE WEBSITE: <https://canvas.illinois.edu/courses/43547>
I encourage you to use the discussion forum in Canvas. There, you can ask questions about lecture, homework, lab, etc., and use it as a way to meet and interact with other students (if interacting with others is of interest). The platform will let you benefit from the collective knowledge of your classmates and instructors.

TEXTBOOK: Recommended Textbook*
Fundamentals of Fluid Mechanics (8th Edition), Munson, Okiishi, Huebsch, and Rothmayer, Wiley.
(It is not guaranteed that everything covered in lecture is found verbatim in the book. Watching the lecture videos and reading the lecture notes is therefore strongly recommended)
Additional Reference Materials:
Mechanics of Fluids, (5th Edition), Potter, Wiggert and Ramadan, Cengage Learning, 2015. *copies are on reserve at Grainger
Fluid Mechanics (8th edition), White, McGraw-Hill, 2016.
You are also encouraged to watch the excellent didactic video material available at: <http://web.mit.edu/hml/ncfmf.html>

GRADING: Homework 20%
Mid-term exams 15+15%
Labs 25%
Final exam 25%

Course grades will be assigned based on final course averages computed using the weighting scheme given above. Your final letter grade will be assigned using the following numerical cutoffs (which may be lowered but will not be raised):
96–100 A+ 92–96 A 89–92 A- 86–89 B+ 82–86 B 79–82 B- 76–79 C+ 72–76 C 69–72 C- 66–69 D+ 62–66 D 59–62 D- 0–59 F

HOMEWORK: Homework is an important element of the course as it determines your final grade (20%). The main purpose of homework is to prepare you for the exam and progressively learn the contents of the class. Please follow the guidelines:
1. Neatly summarize in works the problems to be solved including all assumptions made during the solution.
2. Include sketches showing coordinates, lengths, control volumes/surfaces and free-body diagrams as needed.
3. Show all relevant steps of the analysis, clearly indicate the final results (with a box or doubly underlined). **INCLUDE ALL UNITS** in your calculations.

4. One problem per page.
5. Be neat, use the space appropriately on the page.
6. Make sure that you write your name on each sheet of paper and staple them together.

Homework will be assigned **before class on Wednesday** each week as the appropriate material is covered and posted on Canvas. It will be collected online **before 11 am in class the following Wednesday**. Late homework will not be accepted without prior arrangement and a good reason (as outlined in University of Illinois rules).

EXAMS: Exams are meant to assess your understandings of the concepts illustrated throughout the course. Two mid-term exams will be given in class throughout the semester during the lecture period, with tentative dates of **Feb. 21** and **Apr. 12**. The final exam will be of the same format as the mid-term exams but will be comprehensive in nature. The exams will be held as **CLOSED-BOOK** exams, but one **self-prepared page (two sides) of hand-written notes** will be allowed. Make-up examinations will only be given with good reason (per U of I rules) and prior arrangement with the instructor.

ATTENDANCE: **Lecture attendance is expected.** Although the instructor will not take roll call (which is subject to change as the semester goes), you are expected to participate in class activities. (**Note:** Absence from class is not an excuse for missing announcements, assignments, etc.)

FEEDBACKS: Feedbacks, critics or advices aimed at improving the class are **very much welcome**. You are strongly encouraged to share any difficulty you may experience. I am open to discuss any issue at any time and adjust accordingly.

DISABILITY STATEMENT To obtain disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor and the Disability Resources and Educational Services (DRES) as soon as possible. To contact DRES, you may visit 1207 S. Oak St., Champaign, call 333-4603, e-mail disability@illinois.edu or go to the DRES website. If you are concerned you have a disability-related condition that is impacting your academic progress, there are academic screening appointments available on campus that can help diagnosis a previously undiagnosed disability by visiting the DRES website and selecting "Sign-Up for an Academic Screening" at the bottom of the page.

ACADEMIC INTEGRITY: Infractions will not be tolerated; they will be dealt with using the most stringent available counter-measures. See the University's Student Code, Article 1, Part 4: <http://studentcode.illinois.edu/article1/part4/1-401/> While you will perform class or lab activities, each student must prepare **his/her own written report**. Receiving help from a classmate, the instructor, or TAs is fine, but the final assignment turned in must be your **own work**. not a copy of someone else's. **Plagiarism is a serious ethical violation and will be dealt with using the most stringent available counter-measures.** TAs will be regularly checking for plagiarized reports. Copying another person's work or using electronic devices or other techniques to gain an unfair advantage during a quiz is considered academic dishonesty. All cases of academic dishonesty will be reported, and it will result in failure of the course. **IT IS NOT WORTH IT!**

Attachment 1: <https://wiki.illinois.edu/wiki/display/ugadvice/Recommended+Syllabus+and+Course+Policy+State+ments>

Sexual Misconduct Reporting Obligation

The University of Illinois is committed to combating sexual misconduct. Faculty and staff members are required to report any instances of sexual misconduct to the University's Title IX Office. In turn, an individual with the Title IX Office will provide information about rights and options, including accommodations, support services, the campus disciplinary process, and law enforcement options.

A list of the designated University employees who, as counselors, confidential advisors, and medical professionals, do not have this reporting responsibility and can maintain confidentiality, can be found here: wecare.illinois.edu/resources/students/#confidential.

Other information about resources and reporting is available here: wecare.illinois.edu.

Academic Integrity

The University of Illinois at Urbana-Champaign Student Code should also be considered as a part of this syllabus. Students should pay particular attention to Article 1, Part 4: Academic Integrity. Read the Code at the following URL: <http://studentcode.illinois.edu/>.

Academic dishonesty may result in a failing grade. Every student is expected to review and abide by the Academic Integrity Policy: <https://studentcode.illinois.edu/article1/part4/1-401/>. Ignorance is not an excuse for any academic dishonesty. It is your responsibility to read this policy to avoid any misunderstanding. Do not hesitate to ask the instructor(s) if you are ever in doubt about what constitutes plagiarism, cheating, or any other breach of academic integrity.

Religious Observances

Illinois law requires the University to reasonably accommodate its students' religious beliefs, observances, and practices in regard to admissions, class attendance, and the scheduling of examinations and work requirements. You should examine this syllabus at the beginning of the semester for potential conflicts between course deadlines and any of your religious observances. If a conflict exists, you should notify your instructor of the conflict and follow the procedure at <https://odos.illinois.edu/community-of-care/resources/students/religious-observances/> to request appropriate accommodations. This should be done in the first two weeks of classes.

Disability-Related Accommodations

To obtain disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor and the Disability Resources and Educational Services (DRES) as soon as possible. To contact DRES, you may visit 1207 S. Oak St., Champaign, call 333-4603, e-mail disability@illinois.edu or go to <https://www.disability.illinois.edu>. If you are concerned you have a disability-related condition that is impacting your academic progress, there are academic screening appointments available that can help diagnosis a previously undiagnosed disability. You may access these by visiting the DRES website and selecting "Request an Academic Screening" at the bottom of the page.

Family Educational Rights and Privacy Act (FERPA)

Any student who has suppressed their directory information pursuant to Family Educational Rights and Privacy Act (FERPA) should self-identify to the instructor to ensure protection of the privacy of their attendance in this course. See <https://registrar.illinois.edu/academic-records/ferpa/> for more information on FERPA.

Attachment 2: https://emails.illinois.edu/files/2056962258/gcoe_syllabusstatement_artf.pdf

Anti-Racism and Inclusivity Statement for Inclusion in Course Syllabi

The intent is to raise student and instructor awareness of the ongoing threat of bias and racism and of the need to take personal responsibility in creating an inclusive learning environment.

The Grainger College of Engineering is committed to the creation of an anti-racist, inclusive community that welcomes diversity along a number of dimensions, including, but not limited to, race, ethnicity and national origins, gender and gender identity, sexuality, disability status, class, age, or religious beliefs. The College recognizes that we are learning together in the midst of the Black Lives Matter movement, that Black, Hispanic, and Indigenous voices and contributions have largely either been excluded from, or not recognized in, science and engineering, and that both overt racism and micro-aggressions threaten the well-being of our students and our university community.

The effectiveness of this course is dependent upon each of us to create a safe and encouraging learning environment that allows for the open exchange of ideas while also ensuring equitable opportunities and respect for all of us. Everyone is expected to help establish and maintain an environment where students, staff, and faculty can contribute without fear of personal ridicule, or intolerant or offensive language. If you witness or experience racism, discrimination, micro-aggressions, or other offensive behavior, you are encouraged to bring this to the attention of the course director if you feel comfortable. You can also report these behaviors to the Bias Assessment and Response Team (BART) (<https://bart.illinois.edu/>). Based on your report, BART members will follow up and reach out to students to make sure they have the support they need to be healthy and safe. If the reported behavior also violates university policy, staff in the Office for Student Conflict Resolution may respond as well and will take appropriate action.