MATH-UA 230/PHYS-UA 180: Introduction to Fluid Dynamics
Spring 2019

Instructor: Antoine Cerfon, Associate Professor of Mathematics, CIMS
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Office hours: Monday: 1:30PM – 2:30PM, Wednesday: 4:00PM – 5:00PM

Expected Schedule

Week	Dates	Topics
1	1/29-31	**Chapter 1** Introduction to continuum physics Review of classical mechanics and thermodynamics
2	2/5-7	**Chapters 2-3** Cartesian Tensor Eulerian and Lagrangian description, Streamlines and streamfunction
3	2/12-14	**Chapters 3-4** Rotation rate and vorticity, Reynolds transport theorem Equation of continuity, Conservation of momentum
4	2/19-21	**Chapter 4** Euler equations Bernoulli function
5	2/26-2/28	**Chapter 4** Stress tensor. The Navier-Stokes equations Energy conservation, Frictional dissipation
6	3/5-7	**Chapter 9** Laminar flow Reynolds number, flow transition and viscosity
7	3/12-14	**Chapter 5** Vorticity and circulation **Review Chapters 1–5, 9**
8	3/26-28	**Chapter 5**: Helmholtz theorem, vorticity equation **Thursday, March 28: Midterm exam**
9	4/2-4	**Chapter 5** Vortex filament, interactions between vortices Fluid flow in a rotating frame
10	4/9-11	**Chapter 7** Potential flow and streamfunction Flow around a cylinder
11	4/16-18	**Chapter 7** Conformal mapping Kutta-Joukowski lift theorem
12	4/23-25	**Chapter 8** Linearization,gravity waves Shallow water waves
13	4/30-5/2	**Chapter 8** Dispersion and group velocity Internal waves and sound waves
14	5/7-9	**Chapter 8** Hydraulic jump and shocks Review
15		**Final Exam–Date and time TBA**

Prerequisites

Students who wish to enroll in this course must meet one of the following prerequisites:

- Calculus III (MATH-UA 123)
- Mathematical Physics (PHYS-UA 016) is suggested to PHYS student.

Course Textbook

The textbook for the course is *Fluid Mechanics, Sixth Edition* by P.K. Kundu, I.M. Cohen and D.R. Dowling, 2015, Academic Press.

This is a nice and complete textbook, which you could find useful in your life as a student and later in industry or in academia. However, if you do not wish to invest in this somewhat expensive book, note that the electronic version of the Fifth edition of the book, which is excellent too, is available for free through NYU Bobcat. Feel free to choose this option! I will post self-sufficient lecture notes after every lecture, and the homework will not make reference to the textbook, so there is not much to lose in doing so.

NYU Classes

The chief means of communication for this course will be the course Classes site, accessed through home.nyu.edu. Students are expected to check this for assignments, lecture notes, and announcements.

Recitation

Recitations will take place every Friday from 11:00AM until 12:15PM in CIWW 201. A teaching assistant will lead class discussions on the course material and homework problems, and be there to answer your questions.

The teaching assistant will also hold office hours, on Fridays from 2:15PM until 3:15PM in CIWW 805.

Exams – Grades

Your course score will be determined as the following weighted average:

Item	Weight
Midterm	25%
Homework	30%
Class participation	10%
Final	35%

Homework assigments

- Assigned weekly, due on Thursdays after class. 10 % penalty if assignment is submitted late on Thursday

  An assignment will not be graded if it is submitted after Thursday. An assignment that is not graded will be given a 0 score.

  Your two lowest scores will be dropped in the calculation of your written homework grade.

Policy on out-of-sequence exams

We are only able to accommodate a limited number of out-of-sequence exams due to limited availability of rooms and proctors. For this reason, we may approve out-of-sequence exams in the following cases:

- A documented medical excuse.
- A University sponsored event such as an athletic tournament, a play, or a musical performance.

  Athletic practices and rehearsals do not fall into this category. Please have your coach, conductor, or other faculty advisor contact your instructor.
- A religious holiday.
- Extreme hardship such as a family emergency.

We will not be able to accommodate out-of-sequence exams and finals for purposes of more convenient travel, including already purchased tickets. Please note again the date of the final and plan your summer travel accordingly.

Scheduled out-of-sequence exams (those not arising from emergencies) must be taken before the actual exam. Makeups must occur within one week of the regularly scheduled exam otherwise a zero score will be given.

If you require additional accommodations as determined by the Center for Student Disabilities, please let your instructor know as soon as possible.

Academic Honesty

Guidelines regarding cheating and plagiarism are laid out in the College of Arts and Sciences guidelines and will be adhered to strictly. Collaboration is permitted, in fact encouraged, for home and class assignments; however, all submitted assignments must be written up independently and represent the student's own work and understanding. Furthermore, collaborations must be acknowledged at the top of the assignment, by naming the participants in it.