

MATH-UA 230/PHYS-UA 180: Introduction to Fluid Dynamics Spring 2018

Course

Fluid dynamics is the branch of physics that describes motions of fluids as varied as the flow of blood in the human body to air around us or the motions of weather systems on Earth. The course introduces important concepts: the Eulerian and Lagrangian descriptions of flow, conservation of mass, energy and momentum, the Euler and Navier-Stokes equations, viscosity and vorticity, inviscid and viscous flows. Applications to real systems are stressed throughout the course.

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.

Textbook

Required: Fox and McDonald's *Introduction to Fluid Mechanics*, 9th edition, Philip J. Pritchard, John W. Mitchell, John Wiley & Sons, ISBN 978-1-11891265-2

Recommended: *Physical Fluid Dynamics*, 2nd edition, D. J. Tritton, Oxford University Press.

A more physics-oriented text, which lacks example problems, but provides a good introduction to the physics, albeit at a more advanced level, than the course textbook.

Schedule

Section	Day	Time	Location	Instructor
001	Tuesday	2:00 - 3:15	GCASL 288, 238 Thompson St.	Dr. Andre Adler
001	Thursday	2:00 - 3:15	GCASL 288, 238 Thompson St.	Dr. Andre Adler
002	Friday	2:00 - 3:15	1045 BW	Giorgi Tukhashvili

GCASL stands for Global Center for Academic and Spiritual Life.

Instructors

Dr. Andre Adler (Lecture)

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Office hours: See NYU Classes

Giorgi Tukhashvili (Recitation)

Office: 726 Broadway, Room 945

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Office hours: See NYU Classes

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 and announcements.

Topic Schedule

Week	Dates	Topics	Text Sections
1	1/23 - 25	Introduction Fundamental Concepts	1.1 to 1.5 2.1 to 2.3
2	1/30 - 2/1	Fundamental Concepts Fluid Statics	2.4 to 2.6 3.1 to 3.3
3	2/6 - 8	Fluid Statics / Quiz 1	3.4 to 3.5
4	2/13 - 15	Basic Equations: Integral Form	4.1 to 4.3
5	2/20 - 22	Basic Equations: Integral Form / Quiz 2	4.4 to 4.5 4.7 to 4.8
6	2/27 - 3/1	Differential Analysis of Fluid Motion	5.1 to 5.4
7	3/6 - 8	Incompressible Inviscid Flow / Quiz 3	6.1 to 6.3
8	3/20 - 22	Incompressible Inviscid Flow	6.4, 6.6
9	3/27 - 29	Dimensional Analysis and Similitude / Quiz 4	7.1 to 7.5
10	4/3 - 5	Internal Incompressible Viscous Flow	8.1 to 8.4
11	4/10 - 12	Internal Incompressible Viscous Flow / Quiz 5	8.5 to 8.7
12	4/17 - 19	Internal Incompressible Viscous Flow	8.8 to 8.9
13	4/24 - 26	External Incompressible Viscous Flow / Quiz 6	9.1 to 9.4
14	5/1 - 3	External Incompressible Viscous Flow	9.5 to 9.7
15	5/8 - 10	Compressible Fluids	12.1 to 12.5

Class

We meet three times each week to explore course content through the readings, classroom problems, and homework problems. Active participation in both lecture and recitation sections is essential and will contribute to your grade (more about that below).

1. Your first engagement with the material is through your reading - doing it before meeting on Tuesdays and Thursdays is essential.
2. The Tuesday/Thursday meetings are designed to be the follow up to that initial reading.
3. Your next step in learning the material is to do the homework assignments. Of course, you can also do this in a group setting - working in small groups is encouraged.
4. Finally, recitation time will be devoted to reviewing the homework problems and answering your questions.

Recitation

Recitation will take place every Friday from 2:00 PM until 3:15 PM in 1045 BW. Giorgi Tukhashvili conducts recitations on answering your questions about the course material and homework problems.

Top Hat Reading Quizzes

These will be assigned once a week, based on weekly reading assignments.

Term Quizzes

These assessments are shorter in length than the final exam and each contributes less to your grade than a full-length exam would. Each will be approximately 30 minutes in length, occurring roughly every two-weeks. The lowest two scores will be dropped. Hence, each exam might be referred to as a low-stakes exam. Topics for each will be focused on the prior two weeks of class.

Homework assignments

Weekly homework assignments will come from your text. Assigned weekly, due on Thursdays after class. An assignment will not be graded if it is submitted after Thursday. Late assignments will be graded for at most, half credit. Those that are not graded will be given a 0 score. Your two lowest scores will be dropped in the calculation of your written homework grade. Assignments will be posted to NYU Classes.

Participation

Our goal is that we all engage in learning at each and every class and recitation meeting.

Grade

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

Item	Weight
Top Hat Reading Quizzes (weekly, 2 lowest to be dropped)	5%
Recitation participation	5%
6 term exams (2 lowest to be dropped)	30%
Homework (weekly, 2 lowest to be dropped)	30%
Final Exam - Tuesday, May 15, 12PM-1:50PM	30%

Policies

Speak with the course and recitation instructors when you miss class, recitation, or the homework deadline. Tell us if you have:

- 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 alternative early exam dates. If you cannot take the final exam and incomplete will be assigned and you will take the final at a later date. So, please note again the dates and plan your summer travel accordingly.