1. Contact
Matthias F. Schneider
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office hours: Mo: 3-5pm

2. web resources:
www.blackboard.bu.edu

3.Prerequisites
Calculus
Basic Physics

4. Course schedule
Lecture, Mo, Wed 10-12pm, Room PHO 202
Discussion, Fri 12-1pm, Room PHO 202
Lab Sessions, 3 Sessions, dates tba

5. Textbook and any recommended/reference texts

a) Major Textbook: "Fundamentals of Fluid Mechanics"
Munson, Young, Okiishi, Huebsch (4^{th} Edition is fine)
Recommendation: Buy (used) online ($20). No expensive new edition necessary!

b) Landau & Lifshitz (Vol. 6)
The most common series of theoretical physics text.
Will be used on occasion.
Chapters will be distributed in class.
You Do Not need to buy this book!

6. Course learning objectives

1. Understand the fundamental essence of Fluid Mechanics and comprehend its difference and relation to mechanics and thermodynamics. What's new in physics?
2. Develop the capability to ably these principles to various problems of larger and smaller scales (rivers and droplets).
3. Being capable to realize and transform a problem from daily life into a set of physical motivated equation.
4. Gain an understanding and practice the mathematical apparatus of fluid mechanics. Dimensional analysis, transport theorem, continuity …
5. Gain experience in performing fluids laboratory experiments as part of a team and interpreting results.
6. Today's research in fluid mechanics with respect to engineering and life science.

7. Grading/assessment policies; how will final grade be assigned.

15% Homework
15% Labs

30% First Exam
40% Final Exam

8. Exam schedule
tba

9. Homework policy – weight; frequency; collaboration policy...

- Weekly Homeworks (pdf's available online)
- Group discussions are highly encouraged (not just about homework)
- Prepare your own: Only Your Own Homework will be graded

10. Lecture by lecture topics and excurses.

1. Introduction, What is a Fluid? Key Players (History)?
2. The ideal Gas, 3D and 2D Pressure, Surface tension;
   Excurse: How do weigh a monomolecular film
3. Surface tension, Excurse: The Lotus and the Marangoni Effect
4. Fluid Statics 1 Excurse: Laplace and the alveoli in our Lungs
5. Fluid Statics 2, Excurse: Use Fluid Statics for Cell Mechanics
6. Bernoulli Equation 1
7. Bernoulli Equation 2 – Application. Excurse: The physics of soccer
8. Fluid kinematics – control volume system – Reynolds transport theorem
9. Finite control volume analysis – Conservation Laws
10. Applications of Reynolds Transport Theorem – Conservation Laws
11. Differential Analysis of Fluid Flow - Conservation Laws
12. Recap: Fundamentals of Thermodynamcis
13. Euler Equation – No Dissipation
14. Navier Stokes Equation 1. Elastic and Dissipative Processes
15. Navier Stokes Equation 2
16. Hydrodynamics and Thermodynamics - Sound Propagation
17. The Reynolds Number. Excursion: Life at Low Reynolds Numbers
18. Dimenionless Analysis, Buckigham Pi Theorem
19. Pipe Flow 1 - Excursion: Blood Flow
20. Pipe Flow 2 – Flow at Bifurcations
21. Bodies in Flow. Excursion: Cell Adhesion under Flow – Blood Clotting
22. Excursion: Nano and Microfluidics. Molecular Motors.
23. Boundary Layers – Slip and Non Slip. Excursion: Lift
24. Computational Fluid Dynamics.

11. Schedule of lab exercises
tba