Texts for Consultation
Fluid Mechanics – Spring 2019

As you start to take more advanced Physics courses, it is quite likely you will want to go to sources beyond your textbook, instructor, and classmates to help you out. Getting help from the internet has become ubiquitous, but – as you probably are aware – using internet sources for help has its own dangers and pitfalls.

In an effort to help you find reliable sources for information, I am giving you this handout of other texts that may aid your learning experience. Although typing something into google is often easier than walking to the library, these sources have the advantage of being known, reliable resources.

Just as a reminder, your recommended text for the course is:

Guyon, E., J-P. Hulin, L. Petit, and C.D. Mitescu (2015). *Physical Hydrodynamics* (2nd Ed.) Oxford University Press.

I'll be honest – I'm not 100% sure this is the best textbook for you to use as we progress through the semester. I have a crude plan of what I want to cover, and the organization of this textbook has helped come up with that plan. My selection of this text is mostly due to the fact that I wanted something that wasn't too applied math-ey, not too engineering-ey, and generally accessible at the undergraduate level. The selection was made largely from a positive review that *my* fluids instructor gave this text book in a book review for the American Journal of Physics: https://aapt.scitation.org/doi/full/10.1119/1.4929153.

As I've begun to prepare for the course, I've gotten more acquainted with this text and – like all texts – it has some real strengths and real weaknesses. Given the audience for this class, I am likely to supplement this text with additional readings from the sources listed below. In particular, I don't believe we will be following this text all that closely at the beginning of the semester while we work on getting everyone on the same page.

On the pages that follow, please find other resources you may find helpful. (This is, of course, only a partial list of books that I'm aware of and/or are on my own bookshelf. There are many, many fluid mechanics texts out there; I've just compiled this for your use/reference. There's probably some really good ones I don't know about yet or stupidly forgot to mention.)

- Acheson, D.J. (1990). *Elementary Fluid Dynamics*. Oxford University Press. (I do not yet own this book, but I have heard good things about it. Paging through at Amazon, it appears to be a concise mathematical introduction to the underlying ideas. I am convinced that it is a quality text and will be ordering it soon; just don't know it well enough to identify whether it would be good for you to make part of your collection or not).

- Batchelor, G.K. (1967). *An Introduction to Fluid Mechanics*. Cambridge Mathematical Library. (This is considered the "fluids Bible" by many. It is written at a level sufficiently above our intended course, but if you want to study fluids for a living you'll probably become well acquainted with this text at some point.)

- Faber, T.E. (1995). *Fluid Dynamics for Physicists*. Cambridge University Press. (I may end up regretting not chosing this as our main text. The more of it I read, the more I like it. I may very well end up using this as a guide through a fair portion of the semester.)

- Falkovich, G. (2018). *Fluid Mechanics* (2nd Ed). Cambridge University Press. (I've only had this book for a few weeks. It has the advantage of being remarkably short – only 4 chapters and 200 pages – but it seems to me better suited to readers that may have a bit more previous background in the topic. I have great respect for this scientist's work – but I need to review the text in more detail before I could decide whether it really would be right for this class.)

- Feynman, R.P., R.B. Leighton, and M. Sands (1963). *The Feynman Lectures on Physics* (3 vols). Addison-Wesley. (If you aren't familiar with these books, you should be. Officially used as the basis for a first two-year Physics undergrad sequence at Cal-Tech, these are summaries of Richard Feynman's basic lectures and give an amazing conceptual treatment of most of introductory Physics. Some of the material is a bit dated, but still well worth your time. These books are sometimes called "The Feynman Red Books", because the most familiar edition has a red cover. In particular, I include this reference because of a couple of excellent chapters near the end of volume 2 that discuss "dry" and "wet" water, respectively.)

- Granger, R.A. (1995). *Fluid Mechanics*. Dover. (If you aren't familiar with Dover as a publisher – they publish very affordable books on a wide variety of topics. I don't know much about this text, but I opened it up and immediately saw BTUs, slugs, and pipe flow problems – so I'm guessing that this has an engineering bent to it).

- Holton, J.R. (2004). *An Introduction to Dynamic Meteorology* (4th Ed). Elsevier. (If you want to go on in meteorological studies or work, they will expect you to know the content from this book. We will overlap with many of the ideas, but cover them in a bit of a different way in our course. Since Dr. Holton died, they have come out with a 5th edition (apparently updated by one of Dr. Holton's former students), but the reviews on this more recent edition are mixed at best – the 4th edition is still probably considered the "definitive" version of this text. This book is nearly as central to typical meteorology majors as, say, Griffiths's E&M/Quantum books are to the undergraduate Physics curriculum. If you are a met major, you probably should own this one – despite a lot of students hating it because it is "dry". (One Amazon reviewer suggested it as a sleep aid).).

- Kleinstreuer, C. (1997). *Engineering Fluid Dynamics: An Interdisciplinary Systems Approach*, Cambridge University Press. (I know very little about this book – not even sure where I picked it up. Engineering is right in the title, so you probably have a general sense of the emphasis of this text. Engineering fluids is focused a bit more on particular types of problems than the discipline as a whole – which is ok, but might not be the best approach for the diverse groups of students in this class.)

- Kundu, P.K. and I.M. Cohen (2002). *Fluid Mechanics*, (2nd Ed.) Academic Press. (A relatively standard text. If you want a "traditional" textbook, you could do substantially worse than this text. It is a bit above the level we want to teach at here.)

- Landau, L.D. and E.M. Lifshitz (1959). *Fluid Mechanics* Pergamon Press. (For those of you who aren't aware, Russian Physics Nobel Prize Winner Lev Landau and his student Evgeny Lifshitz wrote a 10-volume series of texts that essentially span the basics of Physics at the graduate level (at least Physics as understood by about 1950). These are beautifully written (though dense and challenging) texts. Some of the Landau/Lifshitz texts are still sometimes used as textbooks in graduate school to this day – including, fairly often, the Fluid Mechanics book. The text is beautiful, but a little bit above the level we want to use as our main text for this class. For example – my text has Euler's equation appear at the bottom of page 3.)

- Lighthill, J. (1988). *An Informal Introduction to Theoretical Fluid Mecahnics* Oxford University Press. (I've heard good things, but have never paged through a copy myself.)

- Lynch, A.H. and J.J. Cassano. (2006). *Applied Atmospheric Dynamics* Wiley. (Looks like a fairly standard atmospheric dynamics textbook, though I must admit I'm mostly judging this by looking at the table of contents. The first half of the book seems more or less a general treatment of fluid systems and flows (with an emphasis on atmospherically relevant ideas like vorticity and circulation) whereas the second half of the book seems largely devoted to applying these basic principles to different weather contexts.)

- Mak, M. (2011). *Atmospheric Dynamics* Cambridge University Press. (Don't know much about this book, but it seems to be a popular option for atmospheric dynamics courses. Those of you who are taking this course as a requirement in the operational meteorology concentration – this is one of the texts that will treat much of the material from this course in a way that may be more relatable to your interests. The table of contents reveals a lot of similar content to what we will be covering in this course, though with different areas of emphasis and different applications, not to mention written by someone with a different background.)

- Pert, G.J. (2013). *Introductory Fluid Mechanics for Physicists and Mathematicians* Wiley. (This is the first time I've taught this course; it has historically been taught by Dr. Fragile but – since he is on sabbatical this year – you are stuck with me. I asked Dr. Fragile for advice and I saw this was a textbook on his recommended list. I was previously unfamiliar with it. It appears the second half of the book focuses on aerodynamics and a variety of other rather uncommon topics for a text like this (rarefactions, deflagrations and detonations, etc.) The first half of the book seems to line up pretty well with a lot of the content from our plan, though).

- Tritton, D.J. (1988). *Physical Fluid Dynamics* Oxford University Press. (I used to own this book, but became frustrated with the fact that the book started with channel flow, which I thought was a needlessly applied beginning to the text. Perhaps I was too hard on it, because I find it spoken of highly. At the very least, I probably should pick up another copy and spend some time with it to see if I was to hasty in removing it off my shelf).

- Vallis, G.K. (2017). *Atmospheric and Oceanic Fluid Dynamics: Fundamentals and Large-Scale Circulation* (2nd Ed). Cambridge University Press. (Pretty much the same text belongs here as I wrote for the Mak text, though googling this a tad seems to suggest this is a pretty challenging text.)

- Van Dyke, M. (1982). *An Album of Fluid Motion* Parabolic Press. (Not really a text book *per se*, but a book worth knowing about. Essentially a picture book of fluid visualizations. I plan to bring this into the class quite a bit over the course of the semester; if you are a believe that a picture is worth 1000 words, this book is an awesome way to familiarize yourself with many of the unique and potentially unfamiliar aspects of fluid flow we'll learn about this semester).

It is also sometimes worth looking back to your PHYS 111/112 text to get another big-picture view of this stuff. Those introductory texts can be helpful more often than you might expect.