Physics 164a: First-year tutorial

Fall 2022

Instructor:  Prof. Matthew Headrick (he)
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Office: Abelson 323
Office hours: By appointment. I am also happy to meet with you at other times by appointment, either in
my office or on Zoom.

Audience & prerequisites:  This course is required for first-year graduate students in physics. It is also
open to undergraduate Physics majors who have completed Physics 31a.

Credits:  Two-Credit Course (with 80 minutes of class time per week). Success in this 2 credit-hour course
is based on the expectation that students will spend a minimum of 4.5 hours of study time per week in
preparation for class (readings, problems, etc.).

Class meetings:  Mondays & Thursdays 11:15 – 11:55 in Abelson 229. As part of this course, you are also
required to attend the department colloquium, on Tuesdays at 4pm. Each student is also required to ask,
during the course of the semester, at least two substantive questions during the question periods.

Content and goals:  This tutorial course will focus on skills for problem-solving, conceptual understanding,
and oral communication that are important for physicists in any field to master. The focus will not be on
any particular area of physics, but we will learn some interesting physics along the way. Some of the specific
goals include:

• To improve your ability to communicate orally about physics with fellow physicists.

• To help you master certain general principles of physics and problem-solving methods such as dimen-
sional analysis, scaling, symmetries, conservation laws, limiting cases, breaking problems down, and
reasoning by analogy.

• To help you learn certain essential facts (such as the values of certain fundamental constants) that are
part of the working knowledge of any physicist.

As a by-product, this course will help prepare the graduate students for the oral qualifying exams.

Assignments:  The first approximately half of the semester will be based on lectures that I will record.
The lectures will include problems for you to solve. You will not hand in your solutions but you should be
prepared to present your solutions to the class.

The second half of the semester will be based on mock quals. You will be given problems to solve, taken
from past qualifying exams, and again are expected to prepare solutions to present to the rest of the class.

For all work in this class, you are allowed and encouraged to work with your fellow students, and to use
any other resources at your disposal — including asking me.

Books:  There is no textbook or assigned reading in this class. However, for the content of the first half of
the semester, I will draw heavily from two excellent books that I encourage you to learn from — if not this
semester then at some point during your education:

•  Fly by Night Physics: How Physicists Use the Backs of Envelopes by A. Zee (see https://www.amazon.
  com/Fly-Night-Physics-Physicists-Envelopes/dp/069118254X/).

•  The Art of Insight in Science and Engineering: Mastering Complexity by Sanjoy Mahajan (MIT Press).
  This book can be downloaded for free at https://mitpress.mit.edu/books/art-insight-science-and-engineering
Mock quals: We will spend the last third of the semester preparing for the oral qualifying exam by doing mock quals. Each week you will be given a problem, one week in advance, from a previous year’s oral qualifying exam. You should solve this problem and prepare a presentation of your solution. In solving the problems, you are encouraged to work together and to use any other resources at your disposal—including asking me!

Exams: There are no exams for this class.

Grade: You will receive an A in this course if you:

- come to class each week having watched the assigned lecture and ready to present solutions to the assigned problems;
- attend the colloquia and ask at least two substantive questions over the course of the semester.

Failure to do one or more of these things will bring your grade down accordingly (roughly by one-third of a letter grade each time, but with the exact penalty at my discretion).

Communication: All assignments and messages about the course will be posted on the course Latte page. Important announcements will be posted on the “Course news and announcements” forum, so be sure you’re subscribed. Please feel free to email me at any time to ask questions about the course, get feedback on how you’re doing in the course, give me feedback or suggestions for improving the course, or ask for a meeting.

Accommodations: Brandeis seeks to welcome and include all students. If you are a student who needs accommodations as outlined in an accommodations letter, I want to support you. In order to provide test accommodations, I need the letter at least 48 hours in advance. I want to provide your accommodations, but cannot do so retroactively. If you have questions about documenting a disability of requesting accommodations, please contact Student Accessibility Support (SAS https://www.brandeis.edu/accessibility/) at 781.736.3470 or access@brandeis.edu.

Disclaimer & feedback: I welcome your feedback about any aspect of the course at any time. Halfway through the semester there will be an opportunity for anonymous feedback. Correspondingly, I reserve the right to change some specifics of this syllabus if, in my judgement, something is not working well. I will announce any change to the syllabus on the “Course new and announcements” Latte forum as well as in class.