Syllabus: Physics 40B, Spring 2020

Last Updated: March 30 (2:12pm)

This is the syllabus for **Physics 40B**: *General Physics* (UCR Spring 2020) **lecture section 020** (Discussion Sections 21, 23, 26, and 27)

Please note: there is a parallel offering of this course (lecture section 001). It is the same course material, but the two courses are otherwise independent.

Physics 40B is the second quarter of the general physics curriculum. We will primarily cover waves and thermodynamics.

All material in this syllabus is subject to changes by the instructor.

Essential Course Information

General Physics, 5 Units, *online* Prerequisites: Physics 40A or 40HA Co-requisite: Math 9C or 9HC

Lecturer: Prof. Flip Tanedo / TA Kuntal Pal

TR 12:30 pm - 1:50pm + discussion section How we will use this time: Most of this course will be *asynchronous*, however we reserve this time for in-person interviews and a good time for chat-based discussions.

Primary Textbook: *Physics for Scientists and Engineers: A Strategic Approach with Modern Physics, 4th Edition*, by Knight. I am not picky about what edition of the book you have, though we will assign problems from the 4th edition.

Secondary Textbook: *Kudu: Physics for Scientists and Engineers*. This quarter Kudu is making their online course platform *free*. We will use this as a secondary reference with course materials and videos.

Course website

https://sites.google.com/ucr.edu/physics40b/

The above course site is a hub for the different tools we'll be using to stay in contact. Instructions will be e-mailed to students on how to sign up for the Kudu site, Slack channel, and Google Classroom.

Software required

Each student is required to have their own computer to access the course materials. We will be using **Slack**, **Google Classroom**, and **Zoom** to communicate. UCR has a Loan2Learn (L2L) program to apply for hardware necessary for remote learning. We will use Google Drive and YouTube for submitting coursework.

Teaching Team

Our job is to guide you through your study of the material in this course. Information for contacting us is at the bottom of this document.

Instructor: Prof. Flip Tanedo ("Professor Tanedo" or "Dr. Tanedo") Prof. Tanedo is a particle physicist who specializes in theories of dark matter. He enjoys science fiction on screen (*Star Trek*) and as short stories (recent favorites: N.K. Jemisen, Ted Chiang). He looks forward to the unique opportunities of teaching this class online.

Teaching Assistant: Kuntal Pal. Kuntal Pal is a 3rd year physics graduate student who works with Professors Jose Wudka and Flip Tanedo. His recent work focuses on how extra dimensions of space can explain what dark matter could be.

Logistics

All courses this quarter are offered *online*. This unique situation is an opportunity. This course will have an intimate learning environment that will be largely *asynchronous*: you will have the flexibility to work on the course on your own schedule, but will be required to engage with other students and the teaching team regularly.

Mastering Physics: course `tanedo04585`

Kudu: Instructions for joining will be sent out via iLearn.

Weekly logistics

We reserve the right to adapt this format as we go along.

A typical week will start with a posted video explaining the goals of the week and the suggested reading as well as sample problems. You will have multiple types of assignments:

1. Practice homework problems that are auto-graded,
2. 5 minute explainer videos that you produce that teach how to solve a type of problem.
3. Critiquing and grading explainer videos from other students.
4. A weekly check in with mini problems and feedback for the teaching team.

You are encouraged to ask questions and connect with other students and the teaching team using the class Slack channel. The instructor and TA will hold live question & answer sessions on Zoom (virtual office hours) during part of the designated lecture/discussion hours.

Instructor Live Q&A session: Tuesdays 12:30 - 12:50pm **TA Live Q&A session**: arranged within the discussion sections.

Over the course of the quarter, each student will also have a 10 minute interview with the instructor and a 10 minute interview with the TA. These interviews will be part oral exam and part feedback for the teaching team. We will schedule meeting slots during the scheduled class section times with *some* flexibility for additional time slots during the week.

Examinations

Our scheduled exam slot is Thursday, June 11, 11:30 pm -- 2:30 pm. We will *not* be using this time slot.

The two interviews with the teaching team during the quarter will serve as course examinations. The cumulative work of all submitted explainer videos will serve as evidence of each students work and will be reviewed holistically when assigning final grades.

We *may* have a final assignment assigned on week 10 to serve as a final cumulative project; this assignment would have roughly the same format and grade weight as any other weekly assignment.

Course Learning Objectives

This course is a mixture of different topics in physics. The unifying theme is the *first principles* approach we take to solving problems.

- *Interpret what equations mean to describe physical phenomena.* It will not be necessary to memorize any equations, but you will need to know how and when to use equations to answer questions about nature.
- *Explain how to solve problems to peers by motivating the process, describing the steps, and identifying pitfalls.* (Or: I don't care if you have a correct answer, I care if you can clearly explain a correct method.) You will know that you understand something when you can teach your peers how to solve problems.

These two principle emphasize a type of learning that will carry over to your upper division courses and your careers. We don't need to memorize details---the real world has Google and Wikipedia. Being able to communicate technical ideas, on the other hand, is a critical part of nearly every modern profession.

Assessment and Grading

Your course grade will be based on the following components:

- **Weekly Assignments on Google Classroom and Mastering Physics (or Kudu)**. [15%] These are short assessments where you reflect on the course content and provide feedback to the teaching team about what you need to succeed.
- **10 minute interview with instructor**. [15%] Once over the course of the quarter you will meet on Zoom with Prof. Tanedo to discuss your progress and for a short oral exam where you explain a problem.
- **10 minute Interview with TA**. [15%] Once over the course of the quarter you will meet on

Zoom with Prof. Tanedo to discuss your progress and for a short oral exam where you explain a problem.
- **Weekly 5 minute explainer videos**. [35%] Each week you will create five minute videos where you teach how to solve problems from the Knight textbook. Each video should be targeted to a hypothetical classmate who has asked you for help.
- **Peer critiques of explainer videos**. [15%] Each week, you will *critique* several students' explainer videos. You will grade them based on a rubric, give constructive feedback, and ask questions on steps that are not clear. Your critiques must reflect your own understanding of the material.
- **Peer critique responses**. [5%] You may write a brief response to your peer critiques to answer any questions, politely disagree, or acknowledge mistakes and suggest corrections. You may appeal for additional partial credit (maximum: 50% of the missing points) on your original explainer video if you have made major corrections.
- **Extra credit**. There may be additional assignments for bonus points; these will focus on peer critiques or explainers for extra topics in the course. Some credit may be given for high quality discussions in the Slack channel that benefit the whole class. There will be *no* opportunities for extra credit in the last 2 weeks of the term. All extra credit opportunities will be announced to the whole class, do not ask for any extra credit assignments just for yourself.

Course Explainers

It is challenging to make a video of yourself explaining physics. The goal with these videos is to show understanding and to be a useful reference for other students: they should be pedagogical.

- State the problem clearly. What do you know, what do you need to figure out?
- Give intuition about the problem. What do you expect the answer to be? (The *expectation* doesn't have to be the "right" answer---some problems may be tricky!)
- State the approach clearly. What "tools" (e.g. equations) do you have, and why are you allowed to use them to solve this problem?
- Go through each step and explain clearly what you're doing. Show intermediate steps.
- Take a bit of time re-state the problem and give intuition about the answer.
- Highlight any ideas that may be tricky. (e.g. "One thing that originally confused me about this is...")

Your explainers will be graded on clarity and insight. You will *not* be graded on "production value," do not stress about having a polished product. (The teaching staff will re-weight peer grades if they feel that those grades are biased towards flashy presentations.)

Guidelines:

- The videos must be *strictly* less than 5 minutes. Anything over 5 minutes will not be graded. (Yes, this may mean that you have to make choices about what's important.)
- You are free to collaborate with friends or use any other resources. Is there a Khan Academy video that does a related problem? Great, go ahead and watch it and be inspired. Please cite/acknowledge any external sources. You will be judged on how *you* explain the problem.
- You may use whatever device you'd like to record videos. Some suggestions are available on the

UCR keep learning website. You will upload your materials to (1) Google Classroom for the teaching staff, and (2) YouTube/Google Drive for peer review.
- You do not need fancy technology. You can make a great explainer just by talking into a webcam and occasionally holding up a piece of paper. You can use Power Point/Keynote/Google Slides with screen recording. You can use a device with a stylus and screen recording.
- Submit a pdf or photograph of the written solution along with the video.
- **Privacy**: Sharing your videos with other students is part of the learning process for the class. However, you are *not* required to share the videos with the rest of the world. You can place restrictions on your videos (e.g. "unlisted" on YouTube, or no downloads/view only within organization in Google Drive). The only requirement is that your video is accessible to your peers during the week that it is being reviewed; afterward you may delete or make the videos private. The teaching staff will keep an private copy of your videos through Google Classroom until the end of the quarter that will not be viewable to others.
- **Be mindful of your recording environment**. Make sure you are not recording anyone in the background without their permission. Make sure there is nothing inappropriate in the video. You are responsible for this. Any work that includes inappropriate or offensive material will be given zero credit.
- Cite any sources outside of the course textbook. You can just include a "shout out" slide at the end of the video. This is both for academic honesty, but also so that the teaching staff knows about references that we can share in future version of this course.
- I suggest working out the problem ahead of time and having a rough idea of what you'd like to say. Even then, you may find that you have to do a few takes to get the video how you want it.

What happens when life gets in the way

Grading will anticipate that this is a challenging time. We will grade with the expectation that students may need to drop one week's worth of assignments due to circumstances beyond their control. This means that the following two students will both receive the same grade:

1. Student A who gets 100% on every assignment for each week.
2. Student B who gets 100% on every assignment for each week *except* week 6.

If there are truly *extenuating* circumstances that mean you will be unable to perform the assignments for *more* than one week, contact the instructor at your earliest convenience. You may want to consider withdrawing from the class or taking an incomplete.

Course Philosophy

The Two Questions You Can Always Ask

Questions and discussions are strongly encouraged. Our material will force you to think differently than you do in other classes you have taken, it will be a challenge. Use the Slack channel and the Q&A sessions to ask questions to the class, take time to answer your peers questions or to highlight questions that you also have.

To help, you should *always* feel comfortable to ask the following questions. They are phrased in a way that you will never "look stupid" for asking them:

1. "*Is it obvious that ... ?*" This means: I don't understand something. Maybe I'm looking at it the wrong way, what is the best way to see why this is true?
2. "*Why are we doing this?*" I understand the details, but I do not understand what the big picture is. What is the main point of this lesson?

Teaching Philosophy

1. Learning is a challenge that requires work, commitment, and time.
2. It is dangerous to go alone. Collaborate (with academic integrity).
3. Instructors should never do for students what students can do for themselves.
4. Communicating ideas to a peer audience assesses higher-level understanding of the material

Policies

- **Course load policy**: By UCR Senate Regulation 760, one unit corresponds to 3 hours of course work per week (including time in class). This is a 5 unit class = 3 units of lecture + 1 unit of discussion + 1 unit of lab. You are expected to spend *12 hours per week* on the lecture + discussion parts of this course: this includes reading course materials, asking questions on Slack, working on problems, preparing your videos, and interviewing with the teaching team. If you find that you are spending significantly more than this time on the course, please contact the instructor.
- **Equity and Inclusion policy**: we are committed to creating an inclusive learning space where we respect one another regardless of race/ethnicity, gender identities, gender expressions, sexual orientation, socioeconomic status, age, disabilities, religion, regional background, veteran status, citizenship status, nationality and other diverse identities that we each bring to class.
- **No bullying**: this course requires students to share work with one another. We will treat each other with respect in our constructive criticism and we will not share each others' materials outside our course without their explicit and written permission. Do not be a troll or bully anyone in this course; we are each offering some vulnerability to support this learning environment. The teaching staff reserves the right to punish misbehavior with zero credit on assignments or failure in the course. Seriously, don't be an asshole.
- **"I'm stuck on the homework" policy**: the suggested course of action is:
    1. Discuss with your classmates and/or ask a question during class (not before class, not after class).
    2. If you and your colleagues are confused, contact the TA.
    3. If you are all confused (or there's potentially an error on the homework), contact the instructor.
- **Attendance policy**: Most of this course will be asynchronous. Recorded material will be distributed online. However, a key part of the assessment

- **Late homework** will not be accepted. The peer critique aspect of this course is only fair if your peers have access to your work in a timely manner.
- **Academic integrity**: conduct.ucr.edu/policies/academic-integrity-policies-and-procedures All students are expected to abide by the highest standards of academic integrity. Academic misconduct (cheating) will be reported to the UCR Student Conduct & Academic Integrity Programs and will be penalized to the fullest amount. A brief summary:
    - You are encouraged to collaborate with others on homework and presentations. You are expected to write your solutions based on your own understanding.
    - You are allowed you use any references outside of the assigned course materials. You are expected to *cite* these sources in your submitted work or presentations.
    - When in doubt, ask.
- **Email policy**: See "communications" below.

Weekly Schedule

We may adapt this schedule as needed. The general topics will be the same as other versions of Physics 40B, but we may emphasize/de-emphasize topics as fitting the course.

1. Newton's Gravity (Knight Ch. 13)
2. Fluids and elasticity (Knight Ch. 14)
3. Oscillations (Knight Ch. 15)
4. Traveling Waves (Knight Ch. 16)
5. Superposition (Knight Ch. 17)
6. Thermodynamics: Macroscopic Description of Matter (Knight Ch. 18)
7. Work, Heat, and the First Law of Thermo (Knight Ch. 19)
8. The Micro/Macro Connection (Knight Ch. 20)
9. Heat Engines & Refrigerators (Knight Ch. 21)
10. Rube Goldberg Machines (synthesis of previous weeks)

Laboratory Section

In addition to the Physics 40B lecture (section 20), discussions (section 21, 23, 26, or 27), you are required to enroll in the associated laboratory section. These labs are run separately from lecture and will begin on week 2. The laboratory instructor is Professor Michael Anderson (michaelg.anderson@ucr.edu); please direct inquiries about the lab to him.

The laboratory is important. Everything you learn from the textbook makes science look *clean*. This is not how actual science works. At its core, science is about creativity, testing, and tinkering. The textbook may tell you an equation and tell you a nice story about why it makes sense, but you should always wonder: *how did they figure that out?* The answer is always rooted in experimentation.

Other useful information

Via registrar.ucr.edu/calendar (subject to my ability copy these dates correctly)

- **Last day to drop this course**: April 10, 2020
- **Last day to withdraw** (no fee, appears on transcript): April 17, 2020
- **Last day to change grading basis** (no fee): April 17, 2020

Student Support Services

- **Disability Accommodations**: if you have a disability may affects your ability to participate in this course, please make arrangements with the Student Disability Resource Center (SDRC) within the first week of class, sdrc.ucr.edu/.
- **Counseling**: this is a challenging course during an atypical quarter. If you are concerned that you feel overwhelmed, depressed, or in need of someone to talk to during your time at UCR, you are encouraged to contact Counseling & Psychological Services (CAPS), counseling.ucr.edu/. CAPS is confidential and is a resource that many in academia have turned to at one point or another.
- **Remote Learning**: UCR's *Keep Learning* website contains remote learning resources including instructions for recording a video, using Zoom, and accessing technology.
- **Concerns about the course**: You are strongly encouraged to speak directly to the instructor early in the quarter if there are concerns about the course. If you have concerns regarding severe problems with the course or instructor that you do not feel comfortable bringing to the instructors attention, you may reach out to the ombudsperson, help.ucr.edu/office-ombuds. You are, however, encouraged to speak to the instructor first.

Supplemental Instruction (SI)

The peer supplemental instructors (SI) for this course are **David Wohlwerth** (dwohl001@ucr.edu) and **Richard Yeong** (BCOE, lyeon001@ucr.edu), a 4th year mechanical engineering student. You are encouraged to make use of this resource. Please refer to the UCR Academic Resource Center website on SI for more information.

Communications

I have a question!

The best way to ask questions about the class is through Slack. Ask questions early and often. Contribute your thoughts, be willing to get into polite debates. The teaching staff will keep an eye out and will give credit to those who are especially engaged on Slack.

You may also use our class Slack to ask questions about hardware and software, course logistics, check in with other students, and share recommendations for books/podcasts/television. Be sure to use the appropriate Slack channel.

Urgent announcements

The teaching staff will send occasional "urgent" communications to the class via e-mail using iLearn. We will send copies of these communications to the Slack channel.

Contacting the teaching team

For any question that is *not* for the entire class, you may e-mail the teaching team. Note that this is the *slowest* way of getting a response. We will respond to our class e-mail *once a week* unless there is a particularly urgent matter.

Subject of any e-mail **must** start with `[P40B]` or else it may be filtered out. You may contact us at:

Prof. Tanedo: flip.tanedo@ucr.edu ("Prof. Tanedo" or "Dr. Tanedo") Kuntal Pal: kpal002@ucr.edu

Please be aware that we may ask you to post your question to the Slack if we feel it is beneficial for the entire class.