THE PHYSICS OF SOLAR AND RENEWABLE ENERGY (PHYSICS 162)	
	PROFESSOR RAGHUVEER PARTHASARATHY DEPARTMENT OF PHYSICS
SPRING 2025	THE UNIVERSITY OF OREGON

SYLLABUS

Welcome to "The Physics of Solar and Renewable Energy!" This syllabus contains a lot of information, especially about different components of the course. I'm fond of having a variety of assignments and activities, which makes the class livelier and also helps people learn. This has gone well in the past – students like it, as do I – but it requires a good amount of organization on everyone's part. – *Prof. Parthasarathy*

Please note that aspects of the syllabus may change. If so, I'll inform everyone in class and through Canvas.

Time and Place

Tuesday and Thursday 2:00 - 3:50 pm, Willamette Hall Room 100

The Tuesday period and the first half of the Thursday period will be "normal" classes – lecture, activities, etc. The second half of the Thursday period (approximately 3:00-3:50 pm) will be an open question/discussion time, similar to office hours. Feel free to attend this part or not, as you prefer, but keep in mind that it will likely be helpful.

Instructors and Contact Information

Professor Raghuveer Parthasarathy (pronounced **Par**-tha-**sa**-ra-thē)

Email: raghu@uoregon.edu

Office: Willamette 362

Office hours: W 1:00-1:50 pm, Th 12:30-1:20 pm, Willamette 362

Graduate Teaching Assistant: Logan Page

Email: lop@uoregon.edu

Office hours: Monday 2-3pm and Friday 1:30-2:30 pm, in Willamette 219

Make use of office hours! Even if you don't have specific questions, feel free to drop by. *Office hour times may change*, both by request (if particular times are not good for many students) and due to scheduling conflicts that arise.

Communication / Email: The preferred method of communication is through Canvas, using the Canvas Inbox to send mail to all instructors (the professor and graduate teaching assistant). If you must send a "normal" email, please send it to Professor Parthasarathy, Cc'ing the teaching assistant. Address your message to "Prof. Parthasarathy." We may not reply to emails that begin "Hey" or that are incoherent.

Course Description and Learning Goals

Modern civilization uses vast amounts of energy in forms that are unsustainable and environmentally damaging. What are our alternatives? How do alternative energy sources work, and how much of our needs can they satisfy?

We'll explore these questions, investigating the science behind alternative energy and putting "real numbers" into our characterization of it. Why? It's easy to have good intentions about energy and the environment, but good intentions without quantitative analysis isn't enough to guide important decisions, and it can often do real harm.

Who are you? Being in this course, it's likely that you care about energy issues. Being university students, it's likely that you'll be the decision-makers of the future – businesspeople, policy makers, or at least voters – who will be faced with complex choices having to do with energy and society. The course is designed for **non-science majors**, and we'll develop the ability to make deep insights with simple math.

We'll examine a variety of topics:

1. Present Energy Usage and Sources
2. The Physics of Energy, Power, and Energy Conversion
3. Hydroelectric Power
4. Wind Power
5. Generating and Transporting Electricity
6. Solar Photovoltaics

7. Geothermal and Solar Thermal Energy

8. Biofuels

9. Nuclear Power

10. Batteries and Storage

We'll very briefly comment on fossil fuels and climate change, which are discussed at length in **Physics 161** (*Physics of Energy and the Environment*). Physics 161 **is not** a prerequisite for 162.

Other goals: We will develop our abilities to think critically and quantitatively about scientific issues. Science, contrary to what you may have been mis-taught in the past, is not about "learning facts" but rather about learning how to investigate and draw logical conclusions. We'll practice this!

Students completing the course will have improved their abilities to:

- Understand how physical principles underlie how we use energy.
- Assess and interpret graphs and quantitative data.
- Understand the process by which science generates knowledge.

Prerequisites. There are no scientific prerequisites, and mathematics will be at the level of basic algebra.

Course Platform: Canvas

All course communication will be done through Canvas. Here, you may also view announcements, course materials, homework assignments, and your grades. Please regularly check your email / Canvas notifications for course information.

If you have questions about accessing and using Canvas, visit the Canvas support page. Canvas and Technology Support also is available by phone or live chat: 541-346-4357 | livehelp.uoregon.edu

Textbook

There is no required textbook. The lectures plus readings and videos that will be assigned throughout the term will be sufficient. (See also "Reading Quizzes.") Possibly useful:

- *Energy and Human Ambitions on a Finite Planet.* Tom Murphy. eScholarship, University of California, 2021. It's available **free** online at https://escholarship.org/uc/item/9js5291m. A broad and up-to-date book on energy issues. Part I isn't really necessary and has several parts that many people (myself included) would disagree with; I recommend reading this review of the book: https://aapt.scitation.org/doi/full/10.1119/5.0062183 .

- *Sustainable Energy – Without the Hot Air* by David MacKay, a remarkable book that quantifies a lot of energy-related issues. It's available **free** online at http://www.withouthotair.com/ .

Polling: iClicker Cloud

We will use the "iClicker" software for in-class polling and participation. You will need the **iClicker Cloud app**; I believe it costs $16. (If you already have a current subscription from another course, there is no additional cost.) "Join" the course via https://join.iclicker.com/TKQW . Please see https://www.iclicker.com/getting-started/#student for detailed instructions.

In class

I'll lecture, but not exhaustively. We'll spend quite a bit of time in class on discussions and problem-solving. To have fruitful discussions, it is important for people to have read the pre-class readings and be ready to participate.

Powerpoint slides will be posted after each class on Canvas. As will be discussed, the slides are rather minimal and aren't a substitute for taking notes in class.

Participation. I'll make an announcement about in-class participation Class #1, and I'll update the syllabus after this.

Update: Active Seating

An abundance of research, and my own experience teaching, confirms that active engagement in class enhances student learning. As an added bonus, it makes the class sessions more enjoyable. Of course, it is each student's decision whether or not to actively participate – asking and answering questions, taking part in discussions, etc. However, non-participating students can stifle the mood around them and detract from others' learning experience. Therefore, I've decided to allow students to self-segregate, making use of our large classroom:

- If you want an interactive, hopefully fun, class experience, please sit in the middle section of Willamette 100, in the front half. Be ready to ask and answer questions, talk to your neighbors, etc. (Wrong answers are welcome!)
- If you prefer not to participate, please sit in the side sections of Willamette 100, or in the back half of the middle.

Additional points:

- You can make your choice at each class session, moving wherever you like.
- There are no consequences for your grade, other than that active participation will likely help you! From past experience: there is a large positive correlation between being in the active zone and doing well in the class

- Even in the active zone, I won't call on people at random; I'll ask for volunteers (raising hands). The one exception is group responses in which you chose a "reporter," in which case I may call on random groups.
- You can ask questions regardless of what zone you're in. However, it is *much* easier for me to see people in the front, and to (unintentionally) ignore hands in the back. It's a very long room!

Absences

This course follows the university's policies on absences, described at https://provost.uoregon.edu/course-attendance-and-engagement-policy. Please note the "reason neutral" policy: **instructors "shall not ask for reasons for absences and shall not distinguish between 'excused' and 'unexcused' absences."** Attendance is not mandatory but succeeding in the class without consistent attendance will be very difficult. **Please contact me through Canvas if you will miss class due to extended illness or other issues**. Some university policies are included at the end of this document.

I realize that it is unavoidable that people will have to miss a few classes, for example due to illness. I will therefore **drop certain scores and rescale various grade components** as described below in "Course Components."

There will be no makeup assessments (quizzes or exams). You may not miss an assessment except for reasons beyond your control.

Please let me know by the end of week 2 of the term if you need a testing-related accommodation so we can make the appropriate arrangements.

In case of instructor illness, lectures or office hours may be held via Zoom (see link below) or a lecture recording may be provided.

Course structure and grade components

I'm fond of having a variety of tools for fostering and assessing student learning, rather than just high-stakes exams. (There's a lot of educational research literature that supports this approach.) There are therefore a lot of components to the coursework. These are listed below along with their weight toward the overall course grade.

Reading Assignments and Reading Quizzes. Reading assignments will precede most classes and will usually have "reading quizzes" associated with them, administered through Canvas and due 30 minutes before the start of class. The reading quizzes are intended to be straightforward, with the aim of providing a bit of feedback to facilitate your reading. More comprehensive questions will appear on regular quizzes and exams. *Your lowest two pre-lecture assignment scores will be automatically dropped; see "Absences."*

Post-class notes. Briefly reviewing what one learned from a class session helps cement one's understanding. Within 24 hours of the end of each class, submit a short (less than 300 words)

summary of what the key points of that day's class were. You can also describe things that were unclear or that need further explanation. These will be submitted on-line, via Canvas. The notes will be graded on content (i.e. that they capture something important about the day's lessons) and clarity. We'll give examples of good and bad notes. *I will **rescale the grades** of the post-class notes such that 90% becomes 100%. (In other words, I will divide each student's percentage by 0.9, with a ceiling of 100%. If your original score were 75%, the rescaled score would be 83%.)*

iClicker Poll Questions. There will be in-class poll questions scored by participation only, not the accuracy of the response. We will use "iClicker cloud," which I will discuss in class. You'll need a phone or computer to respond. If you don't have a device like this, please let me know; I am happy to help with alternatives. *Like the post-class notes, I will **rescale the scores** so that 90% counts as 100%; i.e. you can miss 10% of the questions without penalty.*

Quizzes. There will be several short in-class quizzes. They won't be surprises; you'll get advance notice of at least one class. We'll use these to assess understanding of key points without the heavy weight of an exam. *Each student's **lowest quiz score will be dropped** from the total. There won't be any make-up quizzes; if you miss one, this will be the dropped quiz.*

Homework. There will be homework assignments approximately every week. Feel free to discuss the questions with others, but of course, *the work you submit should be your own*. Assignments will be submitted online, via Canvas. Solutions will be posted; **study these.** No late homework will be accepted. *Each student's **lowest score will be dropped** from the overall total.* We will not comment in detail on your homework when grading it. It is therefore important to study the homework solutions.

Projects. There will be three small "projects" that involve assessing the recent history, current usage, and physics-related potential of an alternative energy source: hydroelectric power, wind power, and solar power. These can be done in groups of up to three students.

Exams. There will be one midterm exam, scheduled for ~~Thursday, May 1~~ Tuesday, May 6, and a final exam on Wednesday, June 11, at 12:30 p.m..(Final exam times are set by the Registrar's office; see https://registrar.uoregon.edu/calendars/examinations.) Exams will have a combination of multiple-choice and short-answer questions

Overall Grade

The weights of the components are:

- Reading Assignments and Reading Quizzes: 7%
- Post-class notes: 5%
- iClicker Poll Questions: 3%
- Quizzes: 20%
- Homework: 13%
- Projects: 12%
- Midterm Exam: 20%
- Final Exam: 20%

OVERALL LETTER GRADE:

A 90% to 100%

B 80% to 90%

C 70% to 80%

D 60% to 70%

F lower than 60%

The lower boundaries of the overall course grade ranges may be adjusted downward at the end of the term to account for variations in the difficulty of exams; plusses and minuses will be assigned within these ranges. The exact ranges will be determined after the final assessment, though they will never be moved up compared to these ranges. **It is possible for every student in the class to earn an A grade.**

Generative Artificial Intelligence (GenAI) Use

Students in this class can use GenAI tools such as ChatGPT to help with certain aspects of course work. This includes asking GenAI tools for explanations of terms or concepts, keeping in mind that the explanations might be incorrect. GenAI will probably be able to answer reading quiz questions or possibly homework questions correctly, and you can use this to assess your answers, but you should **not** use this as a substitute for answering questions yourself – the aim of these tasks is to develop your own skills, and you will be assessed on this in-class quizzes and exams. For assignments that involve writing, you might find it useful to bounce ideas off of GenAI tools. However, you cannot use content such as text or graphics created by GenAI tools in your work; rather, you must be the author/creator of your work submissions. Be advised, in accordance with UO policy, if I believe you've handed in work created whole or in part by GenAI tools, I may submit a report of suspected academic misconduct to the Office of Student Conduct and Community Standards for that office to make a determination of responsibility and, if warranted, assess a grade penalty. So, if you are in doubt or have questions about a particular GenAI tool and if its use is okay, check in with me and let's discuss!

How to do well in the course

Plan ahead and start early! This applies to everything in the course – homework, reading assignments, and general studying. It will be crucial to keep up with the course and not fall behind; later topics build on earlier ones.

Workload. This is a 4-credit hour course, so the University's expectation is that you'll spend about 120 hours on course-related work over the term, or 12 hours per week on average, which includes time in class [1].

Make use of resources. If you have questions about anything, come to office hours! Make use of tutorials and teaching assistants as well!

Sleep! Many studies show that sleeping helps memory and understanding. More broadly: physics is a subject that rewards **spaced learning** – a concept may seem unclear at first glance. Then, remarkably, thinking about it again a day later it may suddenly make sense, and a day after that may seem obvious!

University Policies

There are many university policies that are important and useful, focused in many cases on helping students deal with adversity. Please see https://teaching.uoregon.edu/university-course-policies

[1] https://blogs.uoregon.edu/uocc/files/2016/10/Credit-Hour-and-Student-Workload-Policies-2afl3yr.pdf