Faculty of Science - Course Outline

1. Information about the Course

NB: Some of this information is available on the UNSW Handbook[1]

Year of Delivery	2021
Course Code	PHYS1211
Course Name	Energy and the Environment
Academic Unit	School of Physics
Level of Course	1
Units of Credit	6 UOC
Terms Offered	Term 2
Assumed Knowledge, Prerequisites or Co-requisites	There are no pre- or co-requisites
Hours per Week	4 hours of course material, plus one 1-hour pre-lecture quiz, plus one 2-hour synchronous session, plus one 2.5-hour laboratory exercise (or group project) per week. It is expected that students will spend an additional 5 hours per week working on course material, the group project and solving practice problems.
Number of Weeks	10 weeks
Commencement Date	31 May 2021
Component	**Details**
Moodle books	Each week, the learning goals and resources needed to achieve those learning goals are presented in a Moodle book (or sometimes as a PowerPoint presentation). You will work through this material in your own time.
Online quizzes	Every week you will have an online quiz due. The questions will offer you feedback on your understanding of the weekly material and will inform the lecturer about what course content the class is finding particularly challenging. There are typically twenty questions in each quiz, based on the course material covered that week, including questions about what students are finding challenging and are curious about. The purpose of the quiz is largely formative, not summative, i.e., it is to encourage learning and not to measure your performance; therefore for full marks you only need to get about half of the questions right.
Online lectures	Each week, at least one online lecture will be uploaded to Moodle. The lecture will cover material that students found particularly challenging and may address student questions raised in the weekly quiz. Students will go through the online lectures in their own time.
Synchronous hybrid sessions	Each week, there will be a synchronous hybrid (both face-to-face and online) session where the focus is on working on challenging course material using student discussions and group work in breakout rooms. These sessions will not be recorded.
Laboratories	This course has three online laboratory experiments, covered in weeks 8–10. In the laboratory exercises you will collect, analyse and interpret data, expanding on topics covered in the course material.

[1] UNSW Online Handbook: http://www.handbook.unsw.edu.au

	There will be the option to do at least first laboratory experiment in person on campus.
Group project	In weeks 2–7, in groups of three, students will write a report and submit an 8-minute video presentation on a topic relevant to the course.
Practice problems	For about half of the course material there will be practice problem sets (with an emphasis placed on the quantitative course material) with solutions uploaded in Moodle for you to further work through the course material.

2. Staff Involved in the Course

Staff	Role	Name	Contact Details	Consultation Times
Course Convenor		Prof. Michael Ashley	m.ashley@unsw.edu.au	Email to arrange a time
Additional Teaching Staff	Lecturers	Prof. Michael Ashley Dr. Christine Lindstrøm	m.ashley@unsw.edu.au c.lindstrom@unsw.edu.au	Immediately after the synchronous sessions
	Other Support Staff	Zofia Krawczyk-Bernotas	z.krawczyk-bernotas@unsw@edu.au	Email to arrange a time
	Laboratory demonstrators		Laboratory demonstrators will be available online. See Moodle page for details.	2–3pm Wednesday and Friday

3. Course Details

Course Description (Handbook Entry)	Energy, its uses and environmental impacts, thermodynamics, heat engines, heat transfer, solar radiation and its uses, properties of fluids, alternative energy sources, photons and atoms, photovoltaic energy, nuclear science and technology, environmental effects of natural and technological radiation sources, energy management.
Course Aims	The course aims to give students a foundation for becoming educated citizens able to engage with the current topics of the global need for energy, the consequences of this in the form of climate change, and solutions to this problem using renewable energy sources. To achieve this aim, the course begins with a thorough but gentle introduction to thermodynamics, which forms the scientific foundation of the global energy industry. The course has a strong focus on conceptual understanding of the material covered and an emphasis on appreciating implications and applications of the science to current world issues. The course is often taken by aviation students, so the content has been designed to be relevant to that field. For example, the lectures on wind turbines cover airfoil shapes, there is discussion of future energy sources for aviation, and the section on nuclear accidents has lessons for the failure of complex mechanical systems such as aircraft.
Student Learning Outcomes	The course is developed to help students: • Understand the scientific definition of energy, the physical laws it abides by, and how these laws determine what is possible and not in the global energy industry. • Understand how energy is stored in matter as chemical energy and is released or absorbed in chemical processes. • Understand how energy from fossil fuels is converted to useful energy. • Appreciate the history of global energy production and use from the Industrial Revolution until today. • Understand why climate change is an unavoidable consequence of extensive use of fossil fuels as an energy source. • Understand how energy can be obtained from the wind, sun, and hydro power, including details of design and efficiency. • Understand how energy can be obtained from nuclear fission and fusion, including the analysis of historical accidents involving nuclear reactors. • Understand the possibilities for future energy sources for aviation. • Be able to collaborate in teams of three to prepare a short report and 10-minute presentation on a topic related to the course. • Be able to analyse and solve physical problems using mathematics. • Appreciate the role of experimentation—including careful data collection, analysis and interpretation—in understanding the physical world.

	These student learning outcomes are relatively broad and may not cover all course content. Detailed learning goals are provided with the weekly course material in Moodle.
Relationship to Other Courses within the Program	PHYS1211 is a standalone course. It is not part of a physics degree.

4. Rationale and Strategies Underpinning the Course

Teaching Strategies	Due to the ongoing Covid-19 pandemic, the course is mostly taught online in 2021, with hybrid synchronous sessions the only (optional) face-to-face component. This has resulted in certain adaptions. Each week focuses on a specific set of course material. Students are introduced to the weekly material through clear and detailed learning goals informing them explicitly of what they are expected to learn. Students are presented with learning resources (textbook, videos, websites and diagrams) to enable them to achieve the learning goals. To ensure students engage with the material, students will complete a pre-lecture quiz covering the weekly material every week. This quiz has a dual function of requiring students to work more deeply with the material and provide the lecturer with information about what students are finding difficult to learn on their own. In response to the weekly pre-lecture quiz, the lecturer will create a lecture that elaborates on the course material students found particularly challenging. This lecture is recorded asynchronously and uploaded for the students to view. The lecturer will also prepare a 2-hr synchronous session with Peer Instruction questions, group work problems, discussion questions, and opportunities for students to ask questions and clarifications. Students are also required to write their own answers, explanations and/or examples for some of the learning goals; this compilation of a learning goals portfolio will be assessed as part of the exam. In the online laboratory exercises, students will practice and apply important skills such as collecting, analyzing and interpreting data. Laboratory exercises are related to material covered in lectures, giving students an opportunity to work through difficult concepts, with the opportunity to ask a laboratory demonstrator for help online. Students are also provided with practice problems with solutions and past exam papers. These give students additional opportunities to practice solving quantitative and qualitative problems, writing solutions and familiarise themselves with what exam markers are looking for. Note, however, that the course content has been reduced in 2021, so not all past exam questions are relevant.
Rationale for learning and teaching in this course	The design of this course is primarily based on research-based teaching methods that have all been found to significantly increase student learning. The course is designed using constructive alignment (Biggs, 2003), where the course learning goals, assessments and teaching material and activities are all strongly aligned. Spaced practice—in which students engage with the same topic repeatedly but in shorter bursts over a longer period of time—has been

found to be more effective for learning than completing all the engagement with material in one sitting (Dunlosky et al., 2013). Over the course of the week, students engage in spaced practice by first being introduced to the learning goals and the course material, then do the pre-lecture quiz, followed by watching the lecture addressing student difficulties based on the quiz, followed by the synchronous student-active session, before rounding it off with the laboratory exercise.

Student-active learning activities have been found to significantly improve student learning (Freeman et al., 2014). Such activities are the focus of the weekly synchronous sessions to offer opportunities to engage in discussions of course material, address common misconceptions, and practice applying course content to problems and applications. This will primarily be done using Peer Instruction (Mazur, 1997) and Workshop Tutorial style problems (Sharma et al., 1999).

Many studies have shown that students learn effectively by solving problems (e.g., Dunlosky et al., 2013). After being presented with new concepts and ideas, students are given many opportunities to solve problems relating to the material including in the pre-lecture quizzes, synchronous sessions, labs, and practice problems.

Biggs. J. (2003) Teaching for Quality Learning at University – What the Student Does 2nd Edition SRHE / Open University Press, Buckingham.

Dunlosky, Rawson, Marsh, Nathan, & Willingham (2013). Improving students’ learning with effective learning techniques: Promising directions from cognitive and educational psychology. Psychological Science in the Public Interest, 14(1), 4–58.

Mazur, E. (1997). Peer instruction: A user’s manual. Upper Saddle River, New Jersey: Prentice Hall.

Novak, G., Patterson, E., Gavrin, A., & Christian, W. (1999). Just-in-Time Teaching: Blending active learning with web technology. New Jersey: Prentice Hall.

Sharma, M.D., Millar, R. and Seth, S. (1999) Workshop tutorials: Accommodating student centred learning in large first year university physics courses. International Journal of Science Education, 21, 839-853.

Freeman, Eddy, McDonough, Smith, Okoroafor, Jordt, & Wenderoth (2014). Active learning increases student performance in science, engineering, and mathematics. PNAS, 111 (23) 8410-8415

Rationale for assessment

Both formative and summative assessments are used in this course. A wide variety of summative assessments (assessments *of* learning) are used to reflect the variety of learning outcomes (Biggs, 2003) and to lower the stakes of any one assessment. Formative assessments (assessments *for* learning) are also used extensively—in the pre-lecture quiz for Just-in-Time Teaching (Novak et al., 1999) and Peer Instruction questions (Mazur, 1997)—to provide regular and frequent feedback to students on their progress and to allow the lecturer to adjust and adapt the lectures and synchronous session activities to the students’ actual learning needs.

The Dunlosky et al. (2013) meta-analysis showed that the best study techniques students could use to prepare for an exam was to practice answering a large volume of questions over the duration of the course. Both the formative and summative assessments for this course have been designed with this in mind.

The final exam is used to ensure that students are able to solve problems quickly and correctly. The material covered in this course is foundational to many higher year physics and engineering courses so an ability to quickly recall and use skills is vital.

	Labs are also assessed. As physics is an experimental science, a key learning goals is that students are able to conduct measurements to test models.

5. Assessment Tasks and Feedback

Task	Knowledge & abilities assessed	Assessment Criteria	% of total mark	Date of		Feedback		
				Release	Submission	WHO	WHEN	HOW
Pre-lecture quizzes	Solving quantitative problems and answering conceptual questions relating to the entire syllabus of this course.	Students need to correctly answer question and perform calculations to solve problems. To achieve full marks in a quiz, you only need to get about half of the questions right.	2.5% x 8 = 20%	Thursday 8am the week prior	Monday 12pm	Lecturer	Monday 12pm, or Tuesday 9am	Either in the online or synchronous lecture
Lab Exercises	Recognise that physics is an experimental science, conduct experiments and analyse the outcomes.	Marking rubric for each exercise can be found in the laboratory manual.	5% × 3 = 15%	Monday 8am	Friday 5pm weeks 8, 9 & 10	Demonstrator	Friday 5pm the following week	Marked lab uploaded in Moodle
Group project	Ability to write a report and give an 8-minute video presentation, as part of a group of three students, on a topic relevant to the course.	Marking rubrics for the report and presentation will be available on Moodle.	15%	Week 2	Friday 5pm Week 2 (decide groups and topic); Week 5 (presentation); Week 7 (peer review); Week 7 (report)	Peers (for presentation) and lecturer	Week 9	Moodle
Learning goals portfolio	The syllabus broadly by writing answers/explanations (or examples in the case of equations) to several learning goal in the course.	A selection of the learning goals will be assessed as part of the exam.	20%	The portfolio will be due for submitting in Moodle shortly before the exam starts. Details will be published on Moodle.				
Final exam as Moodle quiz	Solving quantitative problems and answering conceptual questions relating to the entire syllabus of this course.	Students need to correctly perform calculations, solve problems and answer conceptual questions.	30%	You can view your exam timetable on myUNSW. This is a 2-hour exam.				

6. Additional Resources and Support

Textbooks	Young, Stadler, Cutnell & Johnson (2018). Cutnell and Johnson's Physics. Hoboken, NJ: John Wiley & Sons. 11th ed. ANZ edition. Note: the library has an eBook subscription to this book. The link is provided on the Moodle site.
Course Manual	All course material will be provided on Moodle.
Required Readings	Lecture notes provided on Moodle.
Additional Readings	Will be made available on Moodle
Recommended Internet Sites	Will be made available on Moodle

7. Required Equipment, Training and Enabling Skills

Equipment Required	Access to a computer to complete online quizzes. There are suitable computers in the UNSW library.
Enabling Skills Training Required to Complete this Course	ELISE It is highly recommended that you complete the Moodle module on academic integrity before submitting assessments for this course.

8. Course Evaluation and Development

Student feedback is gathered periodically by various means. Such feedback is considered carefully with a view to acting on it constructively wherever possible. This course outline conveys how feedback has helped to shape and develop this course.

The School of Physics has a course representative for each course. These will be elected at the start of the course. You can give anonymous feedback to your course representative to be passed onto the lecturers and convener.

Mechanisms of Review	Last Review Date	Comments or Changes Resulting from Reviews
Major Course Review	*T2 2019*	In 2019, the format of the first half of the course was changed from traditional lectures to a Flipped Classroom format with pre-work and a pre-lecture quiz before lectures. This allowed the lecturer to address identified student difficulties with the material in the lectures, and for more student active engagement in class. The change was based on research that shows that students learn more in physics courses that have a higher degree of student activity in class (Hake, 1998; Freeman et al., 2014) and when they interact with the same course material at separated intervals (called distributed practice) and in a way that is more closely aligned with the assessment methods (Dunlosky et al., 2013). Hake, R. R. (1998). Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses. *American journal of Physics, 66*(1), 64-74. Freeman, S. et al. (2014). Active Learning Increases Student Performance in Science, Engineering, and Mathematics. PNAS, 111, 8410-8415. Dunlosky, Rawson, Marsh, Nathan, & Willingham (2013). Improving students' learning with effective learning techniques: Promising directions from cognitive and educational psychology. Psychological Science in the Public Interest, 14(1), 4–58.
myExperience	*T2 2020* *T2 2021*	In 2019, students requested two 2-hour lectures rather than four 1-hour lectures. This has been changed for 2020. Course content has been reduced to adapt to the shorter UNSW3+ system in response to student feedback in course evaluations.
Other	*T2 2020* *T2 2021*	Due to the COVID-19 pandemic, the entire course—including laboratory exercises—was delivered online in 2020. A flipped classroom format was adopted for the second half of the course as well. In 2021, the course continues to be partially constrained by ongoing pandemic measures. Lectures is delivered asynchronously and labs and the final exam will be online. The course is involved in a hybrid mode teaching pilot, using a student active teaching space on campus that enables simultaneous engagement with students who join the synchronous sessions online.

9. Administrative Matters

Expectations of Students	There is an assumption that students will spend 150 hours in total working on course materials for this course. It is expected that students complete all assessments and attend all scheduled synchronous sessions.
Assignment Submissions	All submission times are in Australian Eastern Standard Time (AEST, Sydney). There is a 25% penalty for each day the assignments (lab reports and group project report) are late. This is applied using the time Moodle shows the assignment was submitted (in Turnitin). Students should submit well in advance of the submission deadline as the Moodle can slow down due to heavy usage at the due time. Note that quizzes and peer reviews have a hard deadline and that these must be completed by the deadline. **If a student experiences any difficulty submitting an assignment through Moodle they must email a copy of the assignment to c.lindstrom@unsw.edu.au or m.ashley@unsw.edu.au before the assignment is due, with a report of what went wrong (so that we can fix it). This applies to viewing assignments or submitting them to the Workshop tool as well (for peer review).**
Special consideration	If a student suffers a misadventure and misses an assessment, they should apply for special consideration through myUNSW. This will require evidence to support the claim, such as a doctor's certificate. For all online assessments, this certificate needs to cover at least three days while the assessment (quiz or lab report submission) was available. The UNSW special consideration information can be found here: https://student.unsw.edu.au/special-consideration
Final online exam	For the online Moodle exam, exam rules apply. You can read about these here: https://student.unsw.edu.au/exam-rules
Assessment Procedures[2]	The UNSW assessment policy can be found here: https://www.gs.unsw.edu.au/policy/documents/assessmentpolicy.pdf
Equity and Diversity	Students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course Convenor prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equity and Diversity Unit (9385 4734 or http://www.studentequity.unsw.edu.au/). Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

Student Complaint Procedure[3]	**School Contact**	**Faculty Contact**	**University Contact**
	A. Prof Elizabeth Angstmann First year Physics Director e.angsmtann@unsw.edu.au Or Prof. Adam Micolich Director of Teaching, Physics adam.micolich@unsw.edu.au	Deputy Dean Education A. Prof. Alison Beavis a.beavis@unsw.edu.au	Student Conduct and Appeals Officer (SCAO) within the Office of the Pro-Vice-Chancellor (Students) and Registrar. Telephone 02 9385 8515, email studentcomplaints@unsw.edu.au University Counselling and Psychological Services[4] Tel: 9385 5418

[2] UNSW Assessment Policy
[3] UNSW Student Complaint Procedure
[4] University Counselling and Psychological Services

10. Academic integrity, referencing and plagiarism

Referencing is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism.

Further information about referencing styles can be located at student.unsw.edu.au/referencing

You are encouraged to use Harvard style (author, year) referencing. Examples of how to use referencing follow:

> The taxonomy of the albatross is very complex, and has been described by using up to 12 different genus names (Robertson and Nunn, 1998).
>
> > *"Albatrosses are the most efficient travelers of all vertebrates on the planet. They expend very little energy soaring hundreds of miles over the ocean each day using dynamic soaring and slope soaring. They have a tendon in each shoulder locking their wings fully-extended, so once aloft and soaring across a fair breeze they never need to flap their wings. Like some vultures they hunt by smell, sensitive to the odor of carrion and other biological processes."* (Wikipedia, 2021).
>
> **References**
>
> Robertson, C.J.R, and Nunn. G.B., *Proc First Int Conf Biology and Conservation of Albatrosses*, G. Robertson and R. Gales (Eds), pp13-19, (1998).
>
> Wikipedia, https://en.wikipedia.org/wiki/Albatross (2021)

In this example, the only part containing original writing by the student is shown in turquoise.

Notice how in the example it is very clear (1) where the student got the fact about the 12 genus names from, and (2) that the student copied a paragraph of text from a source (which is fine, provided that you make it very clear by, e.g., using double quotes, indentation, and italics, followed by the source).

Academic integrity is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits: honesty, trust, fairness, respect, responsibility and courage.[5] *At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.*

Further information about academic integrity and plagiarism can be located at:

- *The Current Students site* student.unsw.edu.au/plagiarism*, and*
- *The ELISE training site* subjectguides.library.unsw.edu.au/elise

The Conduct and Integrity Unit provides further resources to assist you to understand your conduct obligations as a student: student.unsw.edu.au/conduct*.*

[5] International Center for Academic Integrity, 'The Fundamental Values of Academic Integrity', T. Fishman (ed), Clemson University, 2013.