UNSW Course Outline

SOLA9001 Photovoltaics - 2024

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General Course Information

Course Code : SOLA9001
Year : 2024
Term : Term 3
Teaching Period : T3
Is a multi-term course? : No
Faculty : Faculty of Engineering
Academic Unit : School of Photovoltaic and Renewable Engineering
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Postgraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

Can we continue to use fossil fuels for electricity? Think about climate change, global warming, and sustainable economy! Photovoltaic (PV) devices convert sunlight directly to electricity with low levels of greenhouse gas emissions per unit of electricity produced. How affordable is photovoltaic electricity? Learn about how different components of the PV systems work, and

how to calculate power generation by a PV system considering effect of factors such as temperature, and efficiency of the components. Using the parameters derived from laboratory exercises and simulations, you will develop a software model of a PV module and use this model to predict electricity generation at given solar irradiation and temperature. As a part of the capstone project, you will develop a PV system design program and use it to design a stand-alone PV system for a real world problem.

Course Aims

The course aims to develop students' understanding of the operation of PV systems. Students will gain skills to calculate performance of PV systems and economic analysis. Importantly, students will develop professional skills to undertake stand-alone PV system design.

Relationship to Other Courses

SOLA2540 is a core course for SOLAAH3707 BE (Honours) Photovoltaic and Solar Energy and SOLABH3707 BE (Honours) Renewable Energy. It is a pre-requisite course for SOLA3020 PV Technology and Manufacturing, SOLA307 Solar Cells and SOLA4012 Photovoltaic Systems Design,

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Describe the key properties of light-matter interaction that impact the performance of a photovoltaic device.
CLO2 : Calculate the incident solar power on a surface understanding the contributions of orientation, tilt, location, spectral change and weather factors.
CLO3 : Calculate output of a PV string at different shading scenarios and array configurations.
CLO4 : Match system components for a particular PV system.
CLO5 : Design a Stand-Alone PV system based on load assessment and site location in compliance with Australian standards.
CLO6 : Analyse payback period and life cycle cost of electricity of a PV system.

Course Learning Outcomes	Assessment Item
CLO1 : Describe the key properties of light-matter interaction that impact the performance of a photovoltaic device.	• Quizzes • Lab reports • PV System Design
CLO2 : Calculate the incident solar power on a surface understanding the contributions of orientation, tilt, location, spectral change and weather factors.	• Quizzes • Lab reports • PV System Design
CLO3 : Calculate output of a PV string at different shading scenarios and array configurations.	• Quizzes • Lab reports • PV System Design
CLO4 : Match system components for a particular PV system.	• Quizzes • Lab reports • PV System Design
CLO5 : Design a Stand-Alone PV system based on load assessment and site location in compliance with Australian standards.	• PV System Design
CLO6 : Analyse payback period and life cycle cost of electricity of a PV system.	• Quizzes • PV System Design

Learning and Teaching Technologies

Moodle - Learning Management System | Echo 360

Other Professional Outcomes

Learning Outcomes	EA Stage 1 Competancies
1. Describe the key properties of light-matter interaction that impact the performance of a photovoltaic device.	PE1.1, PE1.3, PE3.2
2. Calculate the incident solar power on a surface understanding the contributions of orientation, tilt, location, spectral change and weather factors.	PE1.1, PE1.3, PE1.5, PE2.1, PE2.2, PE3.2
3. Calculate output of a PV string at different shading scenarios and array configurations.	PE1.1, PE1.5, PE2.1, PE3.2
4. Match system components for a particular PV system.	PE1.1, PE1.3, PE2.1, PE2.3, PE3.2
5. Design a Stand-Alone PV system based on load assessment and site location in compliance with Australian standards.	PE1.3, PE1.5, PE2.1, PE2.2, PE2.3, PE3.2, PE3.6
6. Calculate payback period and life cycle cost of electricity of a PV system.	PE1.1, PE1.3, PE2.1, PE2.4

Additional Course Information

You are expected to attend all lectures, workshops and labs in order to maximise learning. In addition to the lecture notes and recordings, you will be expected to read relevant texts as required. Group learning is encouraged, but any submitted work must be solely yours, as according to Student Responsibilities and Conduct. UNSW assumes that self-directed study of this kind is undertaken in addition to attending face-to-face classes throughout the course.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Quizzes Assessment Format: Individual	20%	
Lab reports Assessment Format: Individual	30%	
PV System Design Assessment Format: Individual	50%	

Assessment Details

Quizzes

Assessment Overview

Online quizzes will assess understanding of material, and to help with continuous learning. There will be four quizzes during the term. Duration of these quizzes will be between 1 hr to 1.5 hrs. Feedback will be provided within 5 days of the due date through the learning management system.

Course Learning Outcomes

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- CLO3 : Calculate output of a PV string at different shading scenarios and array configurations.
- CLO4 : Match system components for a particular PV system.
- CLO6 : Analyse payback period and life cycle cost of electricity of a PV system.

Assessment Length

8 -12 questions

Generative AI Permission Level

Planning/Design Assistance

You are permitted to use generative AI tools, software or services to generate initial ideas, structures, or outlines. However, you must develop or edit those ideas to such a significant extent that what is submitted is your own work, i.e., what is generated by the tool, software or service should not be a part of your final submission. You should keep copies of your iterations to show your Course Authority if there is any uncertainty about the originality of your work.
If your Convenor has concerns that your answer contains passages of AI-generated text or media that have not been sufficiently modified you may be asked to explain your work, but we recognise that you are permitted to use AI generated text and media as a starting point and some traces may remain. If you are unable to satisfactorily demonstrate your understanding of your submission you may be referred to UNSW Conduct & Integrity Office for investigation for academic misconduct and possible penalties.
For more information on Generative AI and permitted use please see here.

Lab reports

Assessment Overview

In some weeks (see the schedule) you will work on lab projects which are designed to give you an opportunity to apply knowledge to practical problems relating to solar cells and systems. You will write a 6- 10 page long report for each lab answering specific questions. Reports will be marked against assessment criteria. Feedback will be provided online within 10 days of the relevant submission date though the learning management system.

Course Learning Outcomes

- CLO1 : Describe the key properties of light-matter interaction that impact the performance of a photovoltaic device.
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- CLO3 : Calculate output of a PV string at different shading scenarios and array configurations.
- CLO4 : Match system components for a particular PV system.

Assessment Length

10 - 12 pages

Assignment submission Turnitin type

This assignment is submitted through Turnitin and students can see Turnitin similarity reports.

Generative AI Permission Level

Assistance with Attribution

This assessment requires you to write/create a first iteration of your submission yourself. You are then permitted to use generative AI tools, software or services to improve your submission in the ways set out below.
Any output of generative AI tools, software or services that is used within your assessment must be attributed with full referencing.
If outputs of generative AI tools, software or services form part of your submission and are not appropriately attributed, your Convenor will determine whether the omission is significant. If so, you may be asked to explain your submission. If you are unable to satisfactorily demonstrate your understanding of your submission you may be referred to UNSW Conduct & Integrity Office for investigation for academic misconduct and possible penalties.
For more information on Generative AI and permitted use please see here.

PV System Design

Assessment Overview

You will perform Stand-alone PV system design for a given problem including sizing and selection of components and economic analysis. This assignment has four deliverables, (i) Preliminary design report, (ii) PV system design presentation, (iii) PV system design final report, and (iv) Reflection report. Details of each deliverable and submission requirements are given in the assignment brief.

Marking of the reports and presentation will be done with a rubric, Feedback will be provided within 10 days of the relevant due date through the learning management system.

Hurdle requirement:

Students must demonstrate they can design a stand-alone PV system for optimum performance and conformance to relevant Australian Standards. A minimum mark of 60% must be obtained in this assessment in order to pass this course. Failure to achieve this minimum mark will result in an unsatisfactory fail (UF) grade, regardless of the performance in the rest of the course. You may re-submit the final report if a satisfactory performance is not achieved. Your total mark for this assessment will be capped at 60% for the re-submitted work.

Course Learning Outcomes

- CLO1 : Describe the key properties of light-matter interaction that impact the performance of a photovoltaic device.
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- CLO5 : Design a Stand-Alone PV system based on load assessment and site location in compliance with Australian standards.
- CLO6 : Analyse payback period and life cycle cost of electricity of a PV system.

Assignment submission Turnitin type

This assignment is submitted through Turnitin and students can see Turnitin similarity reports.

Hurdle rules

Students must demonstrate they can design a stand-alone PV system for optimum performance and conformance to relevant Australian Standards. A minimum mark of 60% must be obtained in the PV system design assignment in order to pass this course. Failure to achieve this minimum

mark will result in an unsatisfactory fail (UF) grade, regardless of the performance in the rest of the course.

Generative AI Permission Level

Generative AI Software-based Assessments

This assessment is designed for you to use generative AI as part of the assessed learning outcomes. Please refer to the assessment instructions for more details.
For more information on Generative AI and permitted use please see here.

AI is welcomed for drafting pieces of python or excel code as part of the project design.

It is expected that AI will not be use for writing the report, in particular copy pasting of AI content for the report will not be tolerated.

General Assessment Information

Grading Basis

Standard

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 9 September - 15 September	Lecture	PV Systems Load Assessment
	Laboratory	Lab 0: Circuit simulation with LT Spice
Week 2 : 16 September - 22 September	Lecture	Sizing Components: Energy Storage
	Workshop	Load assessment
Week 3 : 23 September - 29 September	Lecture	Solar cells and modules
	Workshop	Energy storage
Week 4 : 30 September - 6 October	Lecture	Solar resource assessment
	Workshop	Resource Assessment
Week 5 : 7 October - 13 October	Lecture	Sizing Components: PV Array Sizing
	Laboratory	Lab 1: Modelling Solar Cells
Week 6 : 14 October - 20 October	Other	Flexibility Week: Possible intensive revision session (TBC based on need)
Week 7 : 21 October - 27 October	Lecture	Sizing Components: PV Array Sizing
	Laboratory	Lab 2, part 1: Mismatch, IV and thermal properties of PV modules
Week 8 : 28 October - 3 November	Lecture	Sizing Components: Inverters
	Laboratory	Lab 2 part 2: Mismatch, IV and thermal properties of PV modules
Week 9 : 4 November - 10 November	Lecture	Installation, design and costing
	Workshop	PV Modules and Array
Week 10 : 11 November - 17 November	Presentation	PV system design presentations

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

Course Resources

Prescribed Resources

Reference Books:

Wenham, S., Green, M., Watt, M. & Corkish, R. (2009) Applied Photovoltaics - 2nd Edition, 2009 Revision, Sydney, Australia, UNSW Centre for Photovoltaic Engineering.

Standalone Power Systems, GSES.

Software:

LT Spice: https://www.analog.com/en/design-center/design-tools-and-calculators/ltspice-simulator.html

On-line Resources:

PV Education: PV Education is an online, interactive website by C.B. Honsberg and S. Bowden covering material similar to this textbook is also available at http://www.pveducation.org/pvcdrom/.

Moodle: As a part of the teaching component, Moodle will be used to disseminate teaching materials, host forums and occasionally quizzes. Announcements concerning course information will be given in the lectures and/or on Moodle. Assessment marks will also be made available via Moodle: https://moodle.telt.unsw.edu.au/login/index.php.

Course Evaluation and Development

Feedback on the course is gathered periodically using various means, including the UNSW myExperience process, informal discussion iduring the term, and the School's Student/Staff meetings. Your feedback is taken seriously, and continual improvements are made to the course based, in part, on such feedback.

In this course, recent improvements resulting from student feedback include removal of non-critical questions from lab assignments, and increasing the weighting for the PV stand-alone PV system design assignment. Final exam has also been removed.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
	Fiacre Rougieux					No	Yes
	Ashraful Hossain Howlader					No	No
	Sijin Wang					No	No

Other Useful Information

Academic Information

I. Special consideration and supplementary assessment

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to, or within 3 working days of, submitting an assessment or sitting an exam.

Please note that UNSW has a Fit to Sit rule, which means that if you sit an exam, you are declaring yourself fit enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see the information on UNSW's Special Consideration page.

II. Administrative matters and links

All students are expected to read and be familiar with UNSW guidelines and polices. In particular, students should be familiar with the following:

- Attendance
- UNSW Email Address
- Special Consideration
- Exams
- Approved Calculators
- Academic Honesty and Plagiarism
- Equitable Learning Services

III. Equity and diversity

Those 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 convener prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equitable Learning Services. 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.

IV. Professional Outcomes and Program Design

Students are able to review the relevant professional outcomes and program designs for their streams by going to the following link: https://www.unsw.edu.au/engineering/student-life/student-resources/program-design.

Note: This course outline sets out the description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle or your primary learning management system (LMS) should be consulted for the up-to-date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline/Moodle/LMS, the description in the Course Outline/Moodle/LMS applies.

Academic Honesty and Plagarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. UNSW has produced a website with a wealth of resources to support students to understand and avoid plagiarism, visit: student.unsw.edu.au/plagiarism. The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the procedures can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in an honours thesis or contract cheating) even suspension from the university. The Student Misconduct Procedures are available here:

www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

Submission of Assessment Tasks

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of five percent (5%) of the maximum mark possible for that assessment item, per calendar day.

The late penalty is applied per calendar day (including weekends and public holidays) that the assessment is overdue. There is no pro-rata of the late penalty for submissions made part way through a day. This is for all assessments where a penalty applies.

Work submitted after five days (120 hours) will not be accepted and a mark of zero will be awarded for that assessment item.

For some assessment items, a late penalty may not be appropriate. These will be clearly indicated in the course outline, and such assessments will receive a mark of zero if not completed by the specified date. Examples include:

- Weekly online tests or laboratory work worth a small proportion of the subject mark;
- Exams, peer feedback and team evaluation surveys;
- Online quizzes where answers are released to students on completion;
- Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date; and,
- Pass/Fail assessment tasks.

Faculty-specific Information

Engineering Student Support Services – The Nucleus - enrolment, progression checks, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

UNSW Study Abroad – study abroad student enquiries (for inbound students)

UNSW Exchange – student exchange enquiries (for inbound students)

UNSW Future Students – potential student enquiries e.g. admissions, fees, programs, credit transfer

Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

School-specific Information

SPREE Student Information Hub

Students are welcome to visit the SPREE Student Information Hub for information such as sample study plans, course outlines, thesis project, industrial training etc.

School Contact Information

For course-related matters, please contact course convenor directly via emails. Please email spreeteaching@unsw.edu.au for any other matters.