UNSW Course Outline

SOLA3010 Low Energy Buildings and Photovoltaics - 2024

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General Course Information

Course Code : SOLA3010
Year : 2024
Term : Term 2
Teaching Period : T2
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, Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

There is currently significant interest in reducing energy use and greenhouse gas production in buildings by designing buildings that are climate-appropriate, implementing energy efficiency measures and producing energy from renewable sources. Prediction of building thermal, lighting

performance and solar access, and techniques for energy efficient design will be introduced, with a focus on residential buildings. A competency in the use of building energy simulation software will be developed.Photovoltaics (PV) is one of the few renewable electricity generation options that can be readily used in urban areas and has no environmental impacts at the site. This course will examine the integration of PV modules into the building envelope. Technical issues associated with the use of PV in buildings and the urban environment, such as heat transfer processes, partial shading, and mismatch and system siting, sizing and configuration will be investigated. System performance assessment and prediction will be introduced.

Relationship to Other Courses

It is assumed that students will have already taken SOLA2540 Applied PV, SOLA9001 Photovoltaics or have equivalent knowledge.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Describe the relationship between building design and thermal and lighting performance, heating, cooling and lighting loads, and human comfort in buildings.
CLO2 : Determine the heat transfer, thermal comfort and lighting performance of a building using manual methods and software, and apply appropriate passive solar and low energy building design strategies.
CLO3 : Assess solar access at a site using manual methods and/or software
CLO4 : Estimate the temperature of BIPV installations and the thermal impact of PV on buildings.
CLO5 : Write a technical report that assesses the performance of various designs of low energy buildings and BIPV systems.

Course Learning Outcomes	Assessment Item
CLO1 : Describe the relationship between building design and thermal and lighting performance, heating, cooling and lighting loads, and human comfort in buildings.	• Final Exam • Quizzes • Assignment
CLO2 : Determine the heat transfer, thermal comfort and lighting performance of a building using manual methods and software, and apply appropriate passive solar and low energy building design strategies.	• Final Exam • Quizzes • Assignment
CLO3 : Assess solar access at a site using manual methods and/or software	• Final Exam • Quizzes • Assignment
CLO4 : Estimate the temperature of BIPV installations and the thermal impact of PV on buildings.	• Final Exam • Quizzes • Assignment
CLO5 : Write a technical report that assesses the performance of various designs of low energy buildings and BIPV systems.	• Final Exam

Learning and Teaching Technologies

Moodle - Learning Management System

Other Professional Outcomes

https://www.unsw.edu.au/engineering/student-life/student-resources/program-design

Additional Course Information

It is assumed that students will have already taken SOLA2540 Applied PV, SOLA9001 Photovoltaics or have equivalent knowledge.

This is a 6 unit-of-credit (UoC) course and involves 5 hours per week (h/w) of face-to-face contact.

The normal workload expectations of a student are approximately 25 hours per term for each UOC, including class contact hours, other learning activities, preparation and time spent on all assessable work.

You should aim to spend about 10 -13 h/w on this course. The additional time should be spent in making sure that you understand the lecture material, completing the set assignments, further reading, and revising for any examinations.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Final Exam Assessment Format: Individual	45%	
Quizzes Assessment Format: Individual	15%	Due Date: Not Applicable
Assignment Assessment Format: Individual	40%	Due Date: 02/08/2024 05:00 PM

Assessment Details

Final Exam

Assessment Overview

Final exam

Course Learning Outcomes

- CLO1 : Describe the relationship between building design and thermal and lighting performance, heating, cooling and lighting loads, and human comfort in buildings.
- CLO2 : Determine the heat transfer, thermal comfort and lighting performance of a building using manual methods and software, and apply appropriate passive solar and low energy building design strategies.
- CLO3 : Assess solar access at a site using manual methods and/or software
- CLO4 : Estimate the temperature of BIPV installations and the thermal impact of PV on

buildings.
- CLO5 : Write a technical report that assesses the performance of various designs of low energy buildings and BIPV systems.

Assessment Length

2 hours

Quizzes

Assessment Overview

Online quizzes

Course Learning Outcomes

- CLO1 : Describe the relationship between building design and thermal and lighting performance, heating, cooling and lighting loads, and human comfort in buildings.
- CLO2 : Determine the heat transfer, thermal comfort and lighting performance of a building using manual methods and software, and apply appropriate passive solar and low energy building design strategies.
- CLO3 : Assess solar access at a site using manual methods and/or software
- CLO4 : Estimate the temperature of BIPV installations and the thermal impact of PV on buildings.

Assessment Length

na

Submission notes

The quizzes must be submitted online via Moodle

Assignment

Assessment Overview

This assignment will involve the use of OpenStudio and PVsyst to simulate the thermal and daylighting performance of a building and the electrical performance of an associated PV system.

Course Learning Outcomes

- CLO1 : Describe the relationship between building design and thermal and lighting performance, heating, cooling and lighting loads, and human comfort in buildings.
- CLO2 : Determine the heat transfer, thermal comfort and lighting performance of a building using manual methods and software, and apply appropriate passive solar and low energy building design strategies.
- CLO3 : Assess solar access at a site using manual methods and/or software
- CLO4 : Estimate the temperature of BIPV installations and the thermal impact of PV on

buildings.

Submission notes

The report must be submitted online via Moodle

General Assessment Information

Grading Basis

Standard

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 27 May - 2 June	Lecture	Topic 1 Course Introduction, Psychrometry and Human Comfort
Week 2 : 3 June - 9 June	Lecture	2 Heat Transfer in Buildings
Week 3 : 10 June - 16 June	Lecture	3 Lighting and Shading
Week 4 : 17 June - 23 June	Lecture	4 Lighting and Shading continued.
	Assessment	Quiz 1 due
Week 5 : 24 June - 30 June	Lecture	5 Climate and Passive Solar
Week 6 : 1 July - 7 July	Other	Flexibility week. No lecture.
Week 7 : 8 July - 14 July	Lecture	7 Climate and Passive Solar cont.
Week 8 : 15 July - 21 July	Lecture	8 Climate and Passive Solar continued.
	Assessment	Quiz 2 due.
Week 9 : 22 July - 28 July	Lecture	9 PV and Buildings
Week 10 : 29 July - 4 August	Lecture	10 BIPV Case Studies.
	Assessment	Assignment due Friday 5pm.

Attendance Requirements

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

Course Resources

Prescribed Resources

UNSW Library website: https://www.library.unsw.edu.au/

Moodle: https://moodle.telt.unsw.edu.au/login/index.php

Reference Books

- Introduction to Architectural Science – S. Szokolay
- Heat and Mass Transfer: A Practical Approach – Y.A. Cengel
- Thermodynamics: An Engineering Approach – Y.A. Cengel, M.A. Boles (useful for psychrometry)

- Energy Efficiency Building Design – Resource Book – Brisbane TAFE – Holger Willrath
- A Handbook on Low-Energy Buildings and District-Energy Systems: Fundamental, Techniques, and Examples – L D Danny Harvey (excellent book! UNSW library has a few hard copies but is also available as an e-book).

Recommended Resources

Online Resources

UNSW Resources

- UNSW Library website: https://www.library.unsw.edu.au/
- Moodle: https://moodle.telt.unsw.edu.au/login/index.php

Climate Information

- Australian Bureau of Meteorology: http://www.bom.gov.au
- NASA – The POWER Project: https://power.larc.nasa.gov/

Low Energy Buildings

- Australian Greenhouse Office "Your Home" technical manual – Good information of residential design and measures to conserve water & energy: http://www.yourhome.gov.au/
- Rocky Mountains Institute: http://www.rmi.org/Buildings
- Victorian Energy Smart Housing Manual: http://www.aprbuildingservices.com.au/C1EnergySmartHousing.html

BIPV Sites

- IEA Task 15: https://iea-pvps.org/research-tasks/enabling-framework-for-the-development-of-bipv/
- Whole Building Design Guide - BIPV - Steven Strong: http://www.wbdg.org/resources/bipv.php

Design Tools

- SAM – Software for photovoltaic Systems: https://sam.nrel.gov/
- OpenStudio – Thermal simulation software utilizing Energy Plus: https://www.openstudio.net
- Energy Plus – Accurate thermal simulation (without visualization): http://www.eere.energy.gov/buildings/energyplus/
- Desktop Radiance - Imaging software for lighting analysis: http://radsite.lbl.gov/deskrad/

Solar Architects

- Bear iD (Netherlands): http://bear-id.com/
- Solar Design Associates (US) http://www.solardesign.com/
- Kiss + Cathcart Architects (New York) http://www.kisscathcart.com/
- Solarcentury (UK) http://www.solarcentury.co.uk/

- Studio E Architects (UK) http://www.studioe.co.uk/
- Architekturbüro Hagemann http://www.architekturbuero-hagemann.com/

- Building Code of Australia - via UNSW Library (sirius)
- NABERS: https://www.nabers.gov.au/
- Green Star: http://www.gbca.org.au/green-star/
- NatHers: http://www.nathers.gov.au/
- AccuRate: http://www.energyinspection.com.au/products/accurate/
- BASIX: http://www.basix.nsw.gov.au/information/index.jsp

Course Evaluation and Development

Feedback on the course is gathered periodically using various means, including the UNSW myExperience process, informal discussion in the final class for the course, 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 …

- The assignment for this course has been simplified and streamlined. For example, ambiguous questions or directions have been avoided.
- Past versions of this course utilized graphical methods for calculating and visualizing shading and solar access. Whenever possible suitable software packages are used instead. However, it is still useful for students to be able to draw simplified examples of shading and solar pathway diagrams.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Gavin Conibeer		Room 245	02 9065 9553	Wednesdays 2 - 3 pm	No	Yes
Lecturer	Alistair Sproul					No	No
Demonstrator	Guo Li					No	No
	Ziyue Feng					No	No
Teaching assistant	Jinyi Guo					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.