UNSW Course Outline

SOLA5053 Wind Energy Converters - 2024

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General Course Information

Course Code : SOLA5053
Year : 2024
Term : Term 1
Teaching Period : T1
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

This course will cover the principles of wind energy and wind power, as well as the design and operation of different types of wind energy converters and grid electricity generation. It will cover issues of site selection, monitoring and analysing wind data, estimating output from wind

generators, integrating wind generators into hybrid power systems or the grid, economics, standards and environmental impacts.

Course Aims

The course aims to provide students with fundamental knowledge and relevant skills for engineers designing and developing wind energy systems. It will largely focus on gridconnected wind farms. Topics will include the physics of the wind resource, wind turbine technologies, wind farm development issues, the integration of wind farms into power systems, and wider economic and social issues.

Relationship to Other Courses

SOLA 5053 builds on the basic lecture material covered in SOLA 1070

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Explain the key underlying science of wind energy, and engineering aspects of wind turbines and wind farms, and their integration into power systems
CLO2 : Demonstrate some key techniques and skills required for designing and siting wind energy systems as well as perform a full wind farm assessment
CLO3 : Analyse and explain the wider economic, social and environmental aspects of wind energy systems

Course Learning Outcomes	Assessment Item
CLO1 : Explain the key underlying science of wind energy, and engineering aspects of wind turbines and wind farms, and their integration into power systems	• Quiz • Assignment • Group Project • Final Examination
CLO2 : Demonstrate some key techniques and skills required for designing and siting wind energy systems as well as perform a full wind farm assessment	• Assignment • Group Project • Final Examination
CLO3 : Analyse and explain the wider economic, social and environmental aspects of wind energy systems	• Group Project • Final Examination

Learning and Teaching Technologies

Moodle - Learning Management System | Microsoft Teams | Echo 360

Learning and Teaching in this course

Lectures will be face to face with materials posted on Moodle

Other Professional Outcomes

After successfully completing this course, you should be able to:

Learning Outcome	EA Stage 1 Competencies
1. Explain the key underlying science of wind energy, and engineering aspects of wind turbines and wind farms, and their integration into power systems	PE1.1, PE1.2, PE1.3, PE2.1
2. Demonstrate some key techniques and skills required for designing and siting wind energy systems as well as perform a full wind farm assessment	PE1.3, PE1.5, PE2.1, PE2.2, PE2.3, PE2.4, PE3.3
3. Analyse and explain the wider economic, social and environmental aspects of wind energy systems	PE1.6, PE3.2, PE3.6

Additional Course Information

Credit points

This is a 6 unit-of-credit (UoC) course and involves between 4 - 6 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 6 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.

Contact hours

This course comprises three-four hours of formal contact per week. The timing and rooms are given below. Tuesday are lecture classes (with additional lectures in weeks 2,3,9 and 10), and the workshop sessions are assigned for revision of key aspects, questions, group work and assignments.

Lectures New South Global Theatre - Tuesday 9-11 (weeks 1-5, 7-10)

Thursday 1-2 (weeks 2,3,9,10)

Please refer to your class timetable for the learning activities you are enrolled in and attend only those classes.Additional revision sessions will be hosted during stuvac and closer to the exam.

Week 6 all groups will come together for a revision session and group work

Summary and Aims of the course

The purpose of this course is to provide students with fundamental knowledge and relevant skills for engineers designing and developing wind energy systems. It will largely focus on grid-connected wind farms. Students will be given an overview of wind energy technology, exploring the advances in wind turbine development over the years. An understanding of the wind resource and characteristics of weather phenomena relevant to wind turbine performance is investigated, along with outlining the aerodynamic principles and mechanics of the wind turbine. Turbine siting and integration issues are covered as well as the wider social and economic issues associated with wind farms. All the topics covered give background information necessary for completion of the major design project – creating a full wind farm feasibility study.

Syllabus

The course will cover topics including:

- The nature of the wind and its use for the production of mechanical and electrical energy
- Components of wind turbines
- Wind turbine aerodynamics
- Mechanical design of components
- Different generator types
- Power system connection of wind turbines
- Operational control of wind turbines
- Wind turbine and wind farm planning and design considerations including community perceptions and environmental issues
- Wind energy economics

Assumed Knowledge

Students should have a good working knowledge of university level physics and mathematics. A basic knowledge of energy systems or renewable energy technologies is useful.

Graduate Attributes

This course will assist students in their development of the following UNSW graduate attributes (as listed at https://my.unsw.edu.au/student/atoz/GraduateAttributes.html):

Understanding their discipline in its interdisciplinary context; Able to apply their knowledge and skills to solving problems; Capable of effective communication; Information literate.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Quiz Assessment Format: Individual	5%	Start Date: in week 3 workshop time Due Date: Week 3: 26 February - 03 March
Assignment Assessment Format: Individual	15%	Start Date: 23/02/2024 12:00 AM Due Date: 18/03/2024 05:00 PM Post Date: 01/04/2024 12:00 AM
Group Project Assessment Format: Group	50%	Start Date: 13/02/2024 09:00 AM Due Date: 22/04/2024 12:00 PM
Final Examination Assessment Format: Individual	30%	

Assessment Details

Quiz

Assessment Overview

In class quizzes covering the first 3 weeks on understanding the weather

Course Learning Outcomes

- CLO1 : Explain the key underlying science of wind energy, and engineering aspects of wind turbines and wind farms, and their integration into power systems

Assessment Length

10 multiple choice questions

Submission notes

Quiz will be accessed via Moodle

Assignment submission Turnitin type

This is not a Turnitin assignment

Assignment

Assessment Overview

Wind data analysis, matching wind turbine curves to wind data. The skills from this assessment are used to learn how to analyse data for their major projects.

Course Learning Outcomes

- CLO1 : Explain the key underlying science of wind energy, and engineering aspects of wind turbines and wind farms, and their integration into power systems
- CLO2 : Demonstrate some key techniques and skills required for designing and siting wind energy systems as well as perform a full wind farm assessment

Assessment Length

5 questions

Submission notes

Submit to Moodle - the assignment must be typed, no handwritten submissions

Assessment information

Details given in assessment brief

Assignment submission Turnitin type

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

Group Project

Assessment Overview

Wind Farm feasibility study. Group project with individual components. Students perform a full feasibility assessment including analysing wind data, choosing appropriate wind turbines, investigating the integration and social and environmental issues, as well as a full economic assessment.

Course Learning Outcomes

- CLO1 : Explain the key underlying science of wind energy, and engineering aspects of wind turbines and wind farms, and their integration into power systems
- CLO2 : Demonstrate some key techniques and skills required for designing and siting wind energy systems as well as perform a full wind farm assessment
- CLO3 : Analyse and explain the wider economic, social and environmental aspects of wind energy systems

Detailed Assessment Description

A detailed breakdown of the assessment and tasks can be found in the assessment brief.

Assessment Length

See details on project sheet for specific deliverables each week

Submission notes

Submit sub-tasks to your group portfolio on Moodle and email a copy to your demonstrator

Assessment information

Students will be assigned into groups of 4-5 students. Detailed marking criteria will be contained in the Project brief. There will be 9 sub-tasks with one submitted per week to become your wind portfolio. A peer assessment componenet at the end of the major project will be used to moderate the final (individual) mark. Your final mark will be based on the subtasks and also your participation in the workshops and your contribution to the tasks. Final submission will be week 11, Monday 22nd April by 12pm.

Assignment submission Turnitin type

Not Applicable

Final Examination

Assessment Overview

Final exam

Course Learning Outcomes

- CLO1 : Explain the key underlying science of wind energy, and engineering aspects of wind turbines and wind farms, and their integration into power systems
- CLO2 : Demonstrate some key techniques and skills required for designing and siting wind energy systems as well as perform a full wind farm assessment
- CLO3 : Analyse and explain the wider economic, social and environmental aspects of wind energy systems

Assessment Length

TBC

Submission notes

Assessment will be on Moodle

Assignment submission Turnitin type

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

General Assessment Information

Assessment overview

The assessment of the course consists of one major group assignment, workshop participation and quiz, one workshop assignment and a final examination paper.

Workshop Quiz week 3, 5%
Workshop Assignment 1 handed out week 2 due week 5, 15%
Group Assignment – breakdown given on assignment sheet 50% (this includes an individual and peer assessment component)
Final Exam 30%

Presentation

All submissions are expected to be neat and clearly set out. Your results are the pinnacle of all your hard work and should be treated with due respect. Presenting results clearly gives the marker the best chance of understanding your method; even if the numerical results are incorrect. All submissions must be typed- no handwritten assignments accepted. All submission must have a cover sheet, stating that the work is your own.

https://www.unsw.edu.au/engineering//sites/default/files/documents/groupcoversheet.pdf

https://www.unsw.edu.au/engineering//sites/default/files/documents/individualcoversheet.pdf

Marking

Marking guidelines for assignment submissions will be provided at the same time as assignment details to assist with meeting assessable requirements. Submissions will be marked according to the marking guidelines provided.

Examinations

You must be available for all quizzes, tests and examinations.

Final examinations for each course are held during the University examination periods: February for Summer Term, May for T1, August for T2, and November/December for T3.

Please visit myUNSW for Provisional Examination timetable publish dates.

For further information on exams, please see the Exams webpage.

Grading Basis

Standard

Requirements to pass course

a passing grade of 50% overall

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 12 February - 18 February	Lecture	13th February - Introduction to wind turbine components and concepts
	Workshop	Group Assignment Briefing (Workshop Briefing Sheet handed out)
Week 2 : 19 February - 25 February	Lecture	20th February - The wind resource 22nd February (1 hour) - The wind resource continued
	Workshop	See Workshop Briefing Sheet handed out week 1 for workshop syllabus Assignment 1 uploaded to Moodle 23rd February
	Group Work	Sub-task 1 due at the start of your workshop class
Week 3 : 26 February - 3 March	Lecture	27th February - Generators 29th February - Wind Resource continued/wake effects
	Workshop	See workshop syllabus for details
	Assessment	Online quiz – you must bring a laptop to class as the quiz is done via moodle in your workshop time
	Group Work	Sub-task 2 due at the start of your workshop class
Week 4 : 4 March - 10 March	Lecture	5th March - Aerodynamics/wake loss models
	Workshop	1 x 2 hour workshop – assignment/project help 1 x 1 hour workshop
	Group Work	Sub-task 3 due at the start of your workshop class
Week 5 : 11 March - 17 March	Lecture	12th March - Wind Finance/Economics
	Workshop	1 x 2 hour workshop- aerodynamics and economics 1 x 1 hour workshop
	Group Work	Sub-task 4 due at the start of your workshop class
Week 6 : 18 March - 24 March	Assessment	Assignment 1 due 9am Monday 18th March. Assignment: Submit to Moodle - the assignment must be typed, no handwritten submissions
	Workshop	No lectures - Intensive revision workshops Monday 18th March 1-4pm F10 June Griffith M18
Week 7 : 25 March - 31 March	Lecture	26th March - Wind Energy Integration I
	Workshop	1 x 2 hour workshop 1 x 1 hour workshop
	Group Work	Sub-task 5 due at the start of your workshop class
Week 8 : 1 April - 7 April	Lecture	2nd April - Wind Energy Integration II
	Workshop	Following syllabus
	Group Work	Sub-task 6 due at the start of your workshop class
Week 9 : 8 April - 14 April	Lecture	9th April - Social/Environmental Context 11th April (1 hour) - Social/Enviro continued and resources
	Workshop	Following syllabus
	Group Work	Sub-task 7 due at the start of your workshop class
Week 10 : 15 April - 21 April	Lecture	16th April - Turbine Components/Materials and design - overview 18th April (1 hour) Forecasting and revision
	Workshop	Following syllabus
	Group Work	Sub-task 8 due at the start of your workshop class
Week 11 : 22 April - 28 April	Group Work	Final Group Report (Subtask 9) due Monday 22nd April by 12pm

Attendance Requirements

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

General Schedule Information

Please refer to your timetable for the workshop times and locations

Course Resources

Prescribed Resources

1. Textbooks. A basic introduction to wind energy can be found in:Godfrey Boyle, “Renewable Energy: Power for a Sustainable Future,” Second edition, Oxford University Press, 2004.

The recommended text for this course is “Wind Energy Explained: Theory, Design and Application” by J.F. Manwell, J.G. McGowan and A.L. Rogers. Copies are available for purchase from the University Bookshop, for loan from the UNSW library open reserve and physical sciences section.

Other suggested reading: “Renewable Electricity and the Grid, the challenge of variability” edited by Godfrey Boyle.

Recommended Resources

Other texts and relevant supplements for this course will be discussed within the relevant lectures

2. Lecture Notes. Lecture notes will be made available on the Moodle site shortly after they are covered.

3. Moodle Site. All handout materials, including lecture notes, workshops and assignments, will be distributed via the official site for this course.

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

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

Additional Costs

N/A

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:

More workshops questions and revision session moved to week 6.

Changing the format of the Major Project to deliverables every week as opposed to one large submission at the end of term.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Merlinde Kay		TETB room 215	9065 5520	Please email to make an appointment	No	Yes
Demonstrator	Anna Matthews				Please contact via MS Teams or email	No	No
	Max Johnson				Please contact via MS Teams or email	No	No
Head demonstrator	Samsudeen Kasim				Please contact via MS Teams or email	No	No
Demonstrator	Finn Parker				Please contact via MS teams or email	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.