COURSE OUTLINE

ELC402 Power System Design and Analysis

School: School of Science, Technology and Engineering

2026 | Semester 2

UniSC Moreton Bay

BLENDED LEARNING

Most of your course is on campus but you may be able to do some components of this course online.

Please go to unisc.edu.au for up to date information on the teaching sessions and campuses where this course is usually offered.

1. What is this course about?

1.1. Description

Modern power systems are going through a paradigm shift due to large scale integration of renewable energy-based energy sources along with energy storage systems. This course will introduce you to the principles, design, and analysis of the emerging concepts such as integration of renewable energy-based energy sources, battery, and hydrogen energy storage systems. It will provide you a hands-on experience using the industry standard software to design, analyse and evaluate stability performances of the modern power system.

1.2. How will this course be delivered?

ACTIVITY	HOURS	BEGINNING WEEK	FREQUENCY
BLENDED LEARNING			
Learning materials – Asynchronous learning materials	1hr	Week 1	13 times
Tutorial/Workshop 1 – On campus tutorial	2hrs	Week 2	10 times
Laboratory 1 – On campus Lab	2hrs	Week 4	5 times
Seminar – On campus seminar	1hr	Week 1	Once Only

1.3. Course Topics

- Overview of conventional power grid and emergence of renewable energy sources (RESs)
- Overview of renewable energy sources (solar, wind and bio-mass)
- Basics of energy storage systems (ESSs)
- Power electronic interfaces for grid integration of RESs and ESSs
- Grid stability with high penetration of RESs
- Microgrids: design. operation and energy management
- Energy Market
- Cyber security

2. What level is this course?

400 Level (Graduate)

Demonstrating coherence and breadth or depth of knowledge and skills. Independent application of knowledge and skills in unfamiliar contexts. Meeting professional requirements and AQF descriptors for the degree. May require pre-requisites where discipline specific introductory or developing knowledge or skills is necessary. Normally undertaken in the third or fourth full-time study year of an undergraduate program.

3. What is the unit value of this course?

12 units

4. How does this course contribute to my learning?

COURSE LEARNING OUTCOMES	GRADUATE QUALITIES MAPPING	PROFESSIONAL STANDARD MAPPING *
On successful completion of this course, you should be able to...	Completing these tasks successfully will contribute to you becoming...	Engineers Australia Stage 1 Professional Engineer Competency Standards
1 Investigate the essential components of renewable energy and energy storage systems through the application of theories and modelling.	Creative and critical thinker	1.1, 1.2, 1.3
2 Solve design problems of renewable energy rich power grids with appropriate models of solar PV systems, wind energy systems and energy storage systems.	Empowered	1.1, 1.5, 2, 2.1, 2.2
3 Critique and apply theories in sustainable design and energy management of microgrids	Creative and critical thinker Sustainability-focussed	1.2, 1.3, 2.2, 2.3
4 Communicate modern power system operation using appropriate engineering terminology, symbols and diagrams.	Engaged	2.4, 3.2, 3.6
5 Demonstrate knowledge of power grid and energy market in de-regulated environment.	Knowledgeable Empowered	1.1, 1.2, 1.5, 1.6, 2.1, 2.2, 3.3

* Competencies by Professional Body

CODE	COMPETENCY
ENGINEERS AUSTRALIA STAGE 1 PROFESSIONAL ENGINEER COMPETENCY STANDARDS	
1.1	Knowledge and Skill Base: Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.
1.2	Knowledge and Skill Base: Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline.
1.3	Knowledge and Skill Base: In-depth understanding of specialist bodies of knowledge within the engineering discipline.
1.5	Knowledge and Skill Base: Knowledge of engineering design practice and contextual factors impacting the engineering discipline.
1.6	Knowledge and Skill Base: Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline.
2	Elements of competency: Engineering Application Ability
2.1	Engineering Application Ability: Application of established engineering methods to complex engineering problem solving.
2.2	Engineering Application Ability: Fluent application of engineering techniques, tools and resources.

CODE	COMPETENCY
2.3	Engineering Application Ability: Application of systematic engineering synthesis and design processes.
2.4	Engineering Application Ability: Application of systematic approaches to the conduct and management of engineering projects.
3.2	Professional and Personal Attributes: Effective oral and written communication in professional and lay domains.
3.3	Professional and Personal Attributes: Creative, innovative and pro-active demeanour.
3.6	Professional and Personal Attributes: Effective team membership and team leadership.

5. Am I eligible to enrol in this course?

Refer to the UniSC Glossary of terms for definitions of “pre-requisites, co-requisites and anti-requisites”.

5.1. Pre-requisites

ELC203

5.2. Co-requisites

Not applicable

5.3. Anti-requisites

Not applicable

5.4. Specific assumed prior knowledge and skills (where applicable)

Not applicable

5.5. Microcredential Information

Not applicable

6. How am I going to be assessed?

6.1. Grading Scale

Standard Grading (GRD)

High Distinction (HD), Distinction (DN), Credit (CR), Pass (PS), Fail (FL).

6.2. Details of early feedback on progress

6.3. Assessment tasks

DELIVERY MODE	TASK NO.	ASSESSMENT PRODUCT	INDIVIDUAL OR GROUP	WEIGHTING %	WHAT IS THE DURATION / LENGTH?	WHEN SHOULD I SUBMIT?	WHERE SHOULD I SUBMIT IT?
All	1	Portfolio	Group	30%	Each task is to be documented in a report and submitted in a group (maximum page limit of 15 pages). Word limit of the report is 1000 words excluding diagrams and calculations. Each of the students in a group of 2 students is expected to write approximately 500 words.	Throughout teaching period (refer to Format)	Online Assignment Submission with plagiarism check
All	2	Artefact - Technical and Scientific, and Written Piece	Individual	30%	The project-based design / case Study report is to be written with a maximum page limit of 10 pages. Word limit of the report is 1500 words excluding diagrams and calculations.	Week 12	Online Assignment Submission with plagiarism check
All	3	Examination - Centrally Scheduled	Individual	40%	2 Hours	Exam Period	Online Assignment Submission with plagiarism check

All - Assessment Task 1: Reports -workshop and site visit

GOAL:	Through this task, the students understanding on the underlaying theories and operational principles of the emerging technologies such as renewable energy systems, energy storage systems, power electronic interfaces etc. will be evaluated.
PRODUCT:	Portfolio
AUTHORSHIP STATEMENT:	
FORMAT:	Maximum of 15 pages including diagrams and calculations. Word limit of the report is 1000 words excluding diagrams and calculations. Format of the report related to each of the task will be provided during the semester in the canvas course site. The task reports for this assessment are due on week 4, week 6, week 8 and week 10.
CRITERIA:	

No.		Learning Outcome assessed
1	Solutions to design problems of renewable energy rich power grids with appropriate models of solar PV systems, wind energy systems and energy storage systems.	2
2	Demonstration of knowledge of power grid and energy market in de-regulated environment.	5

GENERIC SKILLS:	Communication, Problem solving, Applying technologies

All - Assessment Task 2: Project-based Design / Case Study

GOAL:	This task will develop critical thinking and analyzing ability of the students to formulate, design and evaluate performance a power system utilizing the appropriate industry standard or grid requirements.
PRODUCT:	Artefact - Technical and Scientific, and Written Piece
AUTHORSHIP STATEMENT:	
FORMAT:	The maximum page limit of this report is 10 pages. Word limit of the report is 1500 words excluding diagrams and calculations.
CRITERIA:	

No.		Learning Outcome assessed
1	Investigation the essential components of renewable energy and energy storage systems through the application of theories and modelling.	1
2	Communication of modern power system operation using appropriate engineering terminology, symbols and diagrams.	4
3	Demonstration of knowledge of power grid and energy market in de-regulated environment.	5

GENERIC SKILLS:	Communication, Problem solving, Applying technologies

All - Assessment Task 3: Final Exam

GOAL:	The final exam will develop your ability to independently apply your skills and knowledge to solve familiar problem-based questions with confidence within a set time limit and without access to additional resources.
PRODUCT:	Examination - Centrally Scheduled
AUTHORSHIP STATEMENT:	
FORMAT:	Centrally-scheduled exam. You will be provided with a set of analytical and numerical questions. You are required to solve them and upload the answer script in the allocated folder in canvas.
CRITERIA:	

No.		Learning Outcome assessed
1	Investigate the essential components of renewable energy and energy storage systems through the application of theories and modelling.	1
2	Solution to design problems of renewable energy rich power grids with appropriate models of solar PV systems, wind energy systems and energy storage systems.	2
3	Critique and application of theories in sustainable design and energy management of microgrids	3
4	Communication of modern power system operation using appropriate engineering terminology, symbols and diagrams.	4

GENERIC SKILLS:	Communication, Problem solving, Organisation, Applying technologies

7. Directed study hours

A 12-unit course will have total of 150 learning hours which will include directed study hours (including online if required), self-directed learning and completion of assessable tasks. Student workload is calculated at 12.5 learning hours per one unit.

8. What resources do I need to undertake this course?

Please note: Course information, including specific information of recommended readings, learning activities, resources, weekly readings, etc. are available on the course Canvas site– Please log in as soon as possible.

8.1. Prescribed text(s) or course reader

You need regular access to the resource(s) below. Many texts are available as ebooks through the Library at no additional cost.

REQUIRED?	AUTHOR	YEAR	TITLE	EDITION	PUBLISHER
Required	J. Duncan Glover,Mulukutla S. Sarma,Thomas Overbye,Adam Birchfield	2022	Power System Analysis and Design	7th	n/a
Required	Hêmin Golpîra,Arturo Román-Messina,Hassan Bevrani	2021	Renewable Integrated Power System Stability and Control	n/a	John Wiley & Sons
Recommended	Yunus A. Cengel, Dr.,John M. Cimbala,Mehmet Kanoglu	2019	Fundamentals and Applications of Renewable Energy	n/a	McGraw-Hill Education

8.2. Specific requirements

Not applicable

9. How are risks managed in this course?

Risk assessments have been performed for all studio and laboratory classes and a low level of health and safety risk exists. Some risk concerns may include equipment, instruments, and tools; as well as manual handling items within the laboratory. It is your responsibility to review course material, search online, discuss with lecturers and peers and understand the risks associated with your specific course of study and to familiarise yourself with the University's general health and safety principles by reviewing the online induction training for students, and following the instructions of the University staff.

10. What administrative information is relevant to this course?

10.1. Assessment: Academic Integrity

Academic integrity is the ethical standard of university participation. It ensures that students graduate as a result of proving they are competent in their discipline. This is integral in maintaining the value of academic qualifications. Each industry has expectations and standards of the skills and knowledge within that discipline and these are reflected in assessment.

Academic integrity means that you do not engage in any activity that is considered to be academic fraud; including plagiarism, collusion or outsourcing any part of any assessment item to any other person. You are expected to be honest and ethical by completing all work yourself and indicating in your work which ideas and information were developed by you and which were taken from others. You cannot provide your assessment work to others. You are also expected to provide evidence of wide and critical reading, usually by using appropriate academic references.

In order to minimise incidents of academic fraud, this course may require that some of its assessment tasks, when submitted to Canvas, are electronically checked through Turnitin. This software allows for text comparisons to be made between your submitted assessment item and all other work to which Turnitin has access.

10.2. Assessment: Additional Requirements

Eligibility for Supplementary Assessment Your eligibility for supplementary assessment in a course is dependent of the following conditions applying: - The final mark is in the percentage range 47% to 49.4% - The course is graded using the Standard Grading scale - You have not failed an assessment task in the course due to academic misconduct

10.3. Assessment: Submission penalties

Late submission of assessment tasks may be penalised at the following maximum rate: - 5% (of the assessment task's identified value) per day for the first two days from the date identified as the due date for the assessment task. - 10% (of the assessment task's identified value) for the third day - 20% (of the assessment task's identified value) for the fourth day and subsequent days up to and including seven days from the date identified as the due date for the assessment task. - A result of zero is awarded for an assessment task submitted after seven days from the date identified as the due date for the assessment task. Weekdays and weekends are included in the calculation of days late. To request an extension you must contact your course coordinator to negotiate an outcome.

10.4. Links to relevant University policy and procedures

For more information on Academic Learning & Teaching categories including:

- Assessment: Courses and Coursework Programs
- Review of Assessment and Final Grades
- Supplementary Assessment
- Central Examinations
- Deferred Examinations
- Student Conduct
- Students with a Disability

For more information, visit https://www.usc.edu.au/explore/policies-and-procedures#academic-learning-and-teaching

10.5. Student Charter

UniSC is committed to excellence in teaching, research and engagement in an environment that is inclusive, inspiring, safe and respectful. The Student Charter sets out what students can expect from the University, and what in turn is expected of students, to achieve these outcomes.

10.6. General Enquiries

In person:

- **UniSC Sunshine Coast** - Student Central, Ground Floor, Building C, 90 Sippy Downs Drive, Sippy Downs
- **UniSC Moreton Bay** - Service Centre, Ground Floor, Foundation Building, Gympie Road, Petrie
- **UniSC SouthBank** - Student Central, Building A4 (SW1), 52 Merivale Street, South Brisbane
- **UniSC Gympie** - Student Central, 71 Cartwright Road, Gympie
- **UniSC Fraser Coast** - Student Central, Student Central, Building A, 161 Old Maryborough Rd, Hervey Bay
- **UniSC Caboolture** - Student Central, Level 1 Building J, Cnr Manley and Tallon Street, Caboolture

Tel: +61 7 5430 2890

Email: studentcentral@usc.edu.au