ELEC8204

Power Electronics for Renewable and Distributed Generation

Session 2, In person-scheduled-weekday, North Ryde 2026

School of Engineering

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General Information

Unit convenor and teaching staff
Unit Convenor
Leonardo Callegaro
leonardo.callegaro@mq.edu.au
Contact via email
Level 2, 9 Wally's Walk, Room 284
Wed 12:00 - 2:00 PM (upon email appointment)

Credit points
10

Prerequisites
40 CP at 6000 level or above including ELEC6202

Corequisites

Co-badged status

Unit description
This unit develops fundamental knowledge on power electronic converters for renewable energy and distributed generation. Topics of interest include: role of power electronic converters as the enabling technology of a clean and sustainable electricity system; fundamentals of modelling and control of dc-dc converters; single-phase and three-phase grid-connected inverters synchronisation and control principles; power electronics for photovoltaic and wind renewable energy systems; overview of maximum power point tracking concepts; and introduction to converter topologies for high-power applications, such as multilevel-converters and cascaded h-bridge.

Learning in this unit enhances student understanding of global challenges identified by the United Nations Sustainable Development Goals (UNSDGs) Affordable and Clean Energy; Industry, Innovation and Infrastructure; Climate Action

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at https://www.mq.edu.au/study/calendar-of-dates

Learning Outcomes

On successful completion of this unit, you will be able to:

ULO1: Critically evaluate the role of power electronics converters in a green and

sustainable electricity system.

ULO2: Understand principles, analyse control needs and objectives of grid-connected power electronic converters.

ULO3: Understand and explain operation of main photovoltaic and wind interfacing grid-connected power electronic converters.

ULO4: Model dc-dc converters and design controllers to achieve required performance specifications under closed-loop operation.

ULO5: Explain and evaluate operation of advanced converter topologies for high-power applications.

ULO6: Develop teamwork, communication and project management skills to deliver a project solving a problem on an emerging and selected topic in power electronics, in the context of renewable energy and distributed generation.

General Assessment Information

Grading and Passing Requirement for Unit

- In order to pass this Unit a student must obtain a mark of 50 or more for the Unit (i.e. obtain a passing grade P, CR, D, or HD)
- If you are unable to submit an assessment task or attend an in-person assessment because you have been impacted by short term, serious and unavoidable circumstances, you must submit a Special Consideration request in compliance with the criteria in the Special Consideration Policy. If your request is not submitted or not approved, a grade of '0' will be awarded for the assessment. Please ensure you are familiar with the policy before applying.
- For further details about grading, please refer below in the policies and procedures section.

Attendance and Participation

We strongly encourage all students to actively participate in all scheduled learning activities. Regular engagement is crucial for your success in this unit, as these activities provide opportunities to deepen your understanding of the material, collaborate with peers, and receive valuable feedback from instructors, to assist in completing the unit assessments. Your active participation not only enhances your own learning experience but also contributes to a vibrant and dynamic learning environment for everyone.

Release Dates for Assessment Activities

Instructions for assessment tasks will be made available to students by the dates below:

- Practical Assignment: to be released on Week 3 (no later than 16/08/2026)

- Mid-Term Quiz (Class Quiz): to be released on Week 5 (no later than 30/08/2026)
- Project Assessment: to be released on Week 8 (no later than 20/09/2026)

Late Assessment Submission Penalty

- Unless a Special Consideration request has been submitted and approved, a 5% penalty (of the total possible mark of the task) will be applied for each day a written report or presentation assessment is not submitted, up until the 7th day (including weekends). After the 7th day, a grade of '0' will be awarded even if the assessment is submitted. The submission time for all uploaded assessments is **11:55 pm**. A 1-hour grace period will be provided to students who experience a technical concern.
- For any late submission of time-sensitive tasks, such as scheduled tests/exams, performance assessments/presentations, and/or scheduled practical assessments/labs, please apply for Special Consideration.

Short Extensions

Students are allowed to request an extra 3 calendar days to complete eligible assessments. The Assignment assessment is eligible for short extension.

Assessments where Late Submission will (and will not) be accepted

- Assignment - YES, within the short extension timeframe. Special Consideration needs to be granted aftewards.
- Class quiz - NO, unless Special Consideration is granted.
- Project assessment - YES, Standard Late Penalties applies to the iLearn submission (this assessment is not eligible for short extension).

Re-Submission of work

Re-submission of work is not accepted.

Special Consideration

The Special Consideration Policy aims to support students who have been impacted by short-term circumstances or events that are serious, unavoidable and significantly disruptive, and which may affect their performance in assessment. If you experience circumstances or events that affect your ability to complete the assessments in this unit on time, please inform the convenor and submit a Special Consideration request through https://connect.mq.edu.au.

Assessment Tasks

Name	Weighting	Hurdle	Due	Groupwork/Individual	Short Extension	AI Approach
Assignment	30%	No	10/09/2026	Individual	Yes	Open

Name	Weighting	Hurdle	Due	Groupwork/Individual	Short Extension	AI Approach
Class quiz	30%	No	Week 8	Individual	No	Observed
Project assessment	40%	No	Week 13	Individual and Group	No	Open

Assignment

Assessment Type [1]: Practice-based task
Indicative Time on Task [2]: 20 hours
Due: **10/09/2026**
Weighting: **30%**
Groupwork/Individual: Individual
Short extension [3]: Yes
AI Approach: Open

Students will be assessed based on their ability to perform analysis, modelling and implementation of practical experiments as well as software tools.

On successful completion you will be able to:

- Understand and explain operation of main photovoltaic and wind interfacing grid-connected power electronic converters.
- Model dc-dc converters and design controllers to achieve required performance specifications under closed-loop operation.
- Explain and evaluate operation of advanced converter topologies for high-power applications.

Class quiz

Assessment Type [1]: Examination
Indicative Time on Task [2]: 15 hours
Due: **Week 8**
Weighting: **30%**
Groupwork/Individual: Individual
Short extension [3]: No
AI Approach: Observed

The quiz will assess both factual knowledge and problem solving ability.

On successful completion you will be able to:

- Critically evaluate the role of power electronics converters in a green and sustainable electricity system.
- Understand principles, analyse control needs and objectives of grid-connected power

electronic converters.
- Understand and explain operation of main photovoltaic and wind interfacing grid-connected power electronic converters.
- Model dc-dc converters and design controllers to achieve required performance specifications under closed-loop operation.
- Explain and evaluate operation of advanced converter topologies for high-power applications.

Project assessment

Assessment Type [1]: Presentation task
Indicative Time on Task [2]: 25 hours
Due: **Week 13**
Weighting: **40%**
Groupwork/Individual: Individual and Group
Short extension [3]: No
AI Approach: Open

Students will be assessed on their ability to apply theoretical knowledge to practical scenarios, work collaboratively in teams, and demonstrate innovative problem-solving skills.

On successful completion you will be able to:
- Critically evaluate the role of power electronics converters in a green and sustainable electricity system.
- Understand principles, analyse control needs and objectives of grid-connected power electronic converters.
- Understand and explain operation of main photovoltaic and wind interfacing grid-connected power electronic converters.
- Model dc-dc converters and design controllers to achieve required performance specifications under closed-loop operation.
- Develop teamwork, communication and project management skills to deliver a project solving a problem on an emerging and selected topic in power electronics, in the context of renewable energy and distributed generation.

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[1] If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
- Academic Success for academic skills support.

[2] Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation.

[3] An automatic short extension is available for some assessments. Apply through the Service Connect Portal.

Delivery and Resources

Methods of Communication

- Students are reminded the university will communicate all official notices by email to official MQ student's account. Students should read their @student.mq.edu.au email regularly (or forward it to an account they check regularly).
- All announcements and other communication regarding this Unit will be delivered via the iLearn platform.
- Queries to convenors can either be placed on the iLearn discussion board or sent to the unit convenor via the contact email on iLearn .

Unit Website

- The iLearn website for this unit can be found at: https://ilearn.mq.edu.au/login/.
    - *Note! All information and communications relevant to this Unit will be via the iLearn website.*

Textbook

- Power Electronics: A First Course, November 2022, Ned Mohan, Siddharth Raju, Wiley, ISBN: 9781119818564 (Digital version recommended).
- *Remark: While the latest edition of the textbook is recommended, this is not mandatory and students can avail themselves of previous printed or online editions of the textbook*
- Support Website: https://highered.au.wiley.com/support/students/ – link to the Wiley's digital solutions textbook and courseware support page.
    - *Remark: although the textbook for this unit is recommend, it is optional, and relevant information will be provided weekly by the unit convenor.*

Lectures

- Lecture schedule is accessible via the estudent system. The Lecture will comprise of: - discussion session on fundamental knowledge; - practical examples; - interactive Q&A involving students.
- Lectores combine practice-based and traditional teaching modes, and are designed to improve student engagement inside/outside classes.
- Weekly study materials will be posted in the iLearn website to support student's learning.

Practicals

- Practical 1 activities are scheduled according to the to the Unit schedule, please check your timetable in the estudent system.
    - *Note! Students must enrol in one of the available Practical 1 sessions.*
- Interactive PC Labs use PLECS software platform to assist with the modelling and design of power electronics converters.

Projects

- Project activities take place during the second part of the semester.
- The Project covers practical and research aspects of power electronics, with attention to power converters, their control and engineering application.
- Students are required to form teams to work on the Project.

Commencement of activities

- Lectorials (online): start from Week 1.
- Practicals: start from Week 1.

Technology

- The laboratory work will be supported by using the PLECS software platform, an industry-standard software for power electronics design.
- PLECS Standalone software can be downloaded for free from Plexim website and/or or can be used on dedicated Lab PCs.
    - *Note! The PLECS server license will cover only PCs connected to MQ online network.*
    - *Students are encouraged to dowload and install PLECS in their own computer. Licensing instructions on how to obtain a 1-year free version of PLECS will be released by the teaching staff at the start of semester.*

Web Resources

- **PLECS support:**
    - https://plexim.com/support
        - PLECS videos
        - Application examples
        - Technical solutions
        - Installation help

Unit Schedule

An up to date weekly unit schedule is posted on the iLearn website.

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://policies.mq.edu.au). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure
- Assessment Procedure
- Complaints Resolution Procedure for Students and Members of the Public
- Special Consideration Policy

Students seeking more policy resources can visit Student Policies (https://students.mq.edu.au/support/study/policies). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

To find other policies relating to Teaching and Learning, visit Policy Central (https://policies.mq.edu.au) and use the search tool.

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/admin/other-resources/student-conduct

Results

Results published on platform other than eStudent, (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit connect.mq.edu.au or if you are a Global MBA student contact globalmba.support@mq.edu.au

Academic Integrity

At Macquarie, we believe academic integrity – honesty, respect, trust, responsibility, fairness and courage – is at the core of learning, teaching and research. We recognise that meeting the expectations required to complete your assessments can be challenging. So, we offer you a range of resources and services to help you reach your potential, including free online writing and maths support, academic skills development and wellbeing consultations.

Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

Academic Success

Academic Success provides resources to develop your English language proficiency, academic writing, and communication skills.

- Ask a Study Coach
- Access StudyWISE
- Upload an assignment to Studiosity
- Complete the Academic Integrity Module

The Library provides online and face to face support to help you find and use relevant information resources.

- Subject and Research Guides
- Ask a Librarian

Student Services and Support

Macquarie University offers a range of Student Support Services including:

- IT Support
- Accessibility and disability support with study
- Mental health support
- Safety support to respond to bullying, harassment, sexual harassment and sexual assault
- Social support including information about finances, tenancy and legal issues
- Student Advocacy provides independent advice on MQ policies, procedures, and processes

Student Enquiries

Got a question? Ask us via the Service Connect Portal, or contact Service Connect.

IT Help

For help with University computer systems and technology, visit https://students.mq.edu.au/support/technology/service-desk.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.

Changes from Previous Offering

We value student feedback to be able to continually improve the way we offer our units. As such we encourage students to provide constructive feedback via student surveys, to the teaching staff directly, or via the FSE Student Experience & Feedback link in the iLearn page. Student feedback from the previous offering of this unit was very positive overall, with students pleased with the clarity around assessment requirements and the level of support from teaching staff.

Engineers Australia (EA) Competency Mapping

EA Competency Standard		Unit Learning Outcomes
Knowledge and Skill Base	1.1 Comprehensive, theory-based understanding of the underpinning fundamentals applicable to the engineering discipline.	ULO1, ULO2, ULO3, ULO4, ULO5
	1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing.	ULO1, ULO2, ULO3, ULO4, ULO5
	1.3 In-depth understanding of specialist bodies of knowledge	ULO1, ULO2, ULO3, ULO5
	1.4 Discernment of knowledge development and research directions	ULO6
	1.5 Knowledge of engineering design practice	ULO1, ULO2, ULO5
	1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice.	ULO1, ULO6
Engineering Application Ability	2.1 Application of established engineering methods to complex problem solving	ULO1, ULO2, ULO5
	2.2 Fluent application of engineering techniques, tools and resources.	ULO1, ULO2, ULO3, ULO4, ULO5
	2.3 Application of systematic engineering synthesis and design processes.	ULO1, ULO2, ULO3, ULO4, ULO5
	2.4 Application of systematic approaches to the conduct and management of engineering projects.	ULO6
Professional and Personal Attributes	3.1 Ethical conduct and professional accountability.	ULO6
	3.2 Effective oral and written communication in professional and lay domains.	ULO5, ULO6
	3.3 Creative, innovative and pro-active demeanour.	ULO4, ULO5
	3.4 Professional use and management of information.	ULO1, ULO2, ULO6

	3.5 Orderly management of self, and professional conduct.	ULO6
	3.6 Effective team membership and team leadership	ULO4, ULO6

Unit information based on version 2026.02 of the Handbook