



# ELEC6201

## Electrical Machines and Drives

Session 2, In person-scheduled-weekday, North Ryde 2024

*School of Engineering*

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#### **Disclaimer**

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## General Information

Unit convenor and teaching staff

Convenor/Lecturer

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Contact via Email

Room #124, Level 1, 44 WTR

Thursday 2:00 PM - 4:00 PM, by appointment only

Credit points

10

Prerequisites

Corequisites

Co-badged status

This unit is co-badged with ELCT3006.

Unit description

This unit equips students with a profound understanding of the principles governing electric motors, generators, and drive systems, and their applications in modern electrical systems (electrical vehicles, renewable energy systems and high-speed drives). Through a blend of theory, computer modeling, and practical applications, students will master the intricacies and skills necessary for designing, analysing, controlling and selecting appropriate machines for various applications, and to operate them in a safe, efficient and economical manner. Topics include: modelling, efficiency analysis, dynamics, and pros/cons of DC machines (generator and motor - self and separately excited, PMDC), single and three-phase AC machines (induction motor - squirrel-cage and wound rotor), synchronous machines, special machines (reluctance motor, stepper motor, brushless DC motor, etc) and energy-efficient motor drives.

## 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:** Identify and demonstrate operational characteristics of electrical machines for a range of industrial applications, and their roles in green and sustainable electrical

systems.

**ULO2:** Analyse and critically assess key aspects of DC and AC machines for a range of typical applications.

**ULO3:** Design, model and analyse a complete electrical machine application based on a set of specifications.

**ULO4:** Analyse and critically assess key aspects of design and applications of drive systems for a range of motors.

**ULO5:** Apply knowledge of electrical machines and drive systems to real-world applications, such as industrial automation, renewable energy systems, and electric vehicle propulsion.

**ULO6:** Work effectively in teams by: identifying individual roles and responsibilities, sharing knowledge through peer-led learning, writing technical reports and logbooks, and effective communication.

## 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).
- For further details about grading, please refer below in the policies and procedures section.
- If you receive special consideration for the oral presentation and demonstration of the Project, a supplementary conventional exam will be scheduled by the faculty during a supplementary exam period, typically about 3 to 4 weeks after the normal exam period. By making a special consideration application for the oral presentation and demonstration of the Project you are declaring yourself available for a conventional exam during the supplementary examination period and will not be eligible for a second special consideration approval based on pre-existing commitments. Please ensure you are familiar with the policy prior to applying. Approved applicants will receive an individual notification one week prior to the exam with the exact date and time of their supplementary examination.

### 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 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. A 1-hour grace period is 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](#).

### Assessments where Late Submissions will be accepted

In this unit, late submissions will be accepted as follows:

Practical Assignment – YES, Standard Late Penalty applies

Pre-Class Quiz & Mid-Term Quiz - NO, unless Special Consideration is Granted

Project Assessment – YES, Standard Late Penalty applies

### 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 [ask.mq.edu.au](http://ask.mq.edu.au).

## Assessment Tasks

Name	Weighting	Hurdle	Due
<a href="#">Pre-Class Quiz (Lectorials)</a>	10%	No	Weeks 2-7
<a href="#">Assignments (PC Labs)</a>	20%	No	Weeks 2-7
<a href="#">Class Quiz</a>	20%	No	Week 8
<a href="#">Project Design Implementation</a>	50%	No	Weeks 13 & 14

### Pre-Class Quiz (Lectorials)

Assessment Type <sup>1</sup>: Quiz/Test

Indicative Time on Task <sup>2</sup>: 5 hours

Due: **Weeks 2-7**

Weighting: **10%**

Students are expected to go through the iLearn content, understand the theory and attempt the quiz

On successful completion you will be able to:

- Identify and demonstrate operational characteristics of electrical machines for a range of

industrial applications, and their roles in green and sustainable electrical systems.

- Analyse and critically assess key aspects of DC and AC machines for a range of typical applications.
- Apply knowledge of electrical machines and drive systems to real-world applications, such as industrial automation, renewable energy systems, and electric vehicle propulsion.
- Work effectively in teams by: identifying individual roles and responsibilities, sharing knowledge through peer-led learning, writing technical reports and logbooks, and effective communication.

## Assignments (PC Labs)

Assessment Type <sup>1</sup>: Practice-based task

Indicative Time on Task <sup>2</sup>: 12 hours

Due: **Weeks 2-7**

Weighting: **20%**

Evaluation of PC Lab activities and submission of a Lab book. This evaluation focuses on students ability to perform analysis, modelling and implementation of typical electrical machines using simulation tools.

On successful completion you will be able to:

- Identify and demonstrate operational characteristics of electrical machines for a range of industrial applications, and their roles in green and sustainable electrical systems.
- Analyse and critically assess key aspects of DC and AC machines for a range of typical applications.
- Design, model and analyse a complete electrical machine application based on a set of specifications.
- Analyse and critically assess key aspects of design and applications of drive systems for a range of motors.
- Apply knowledge of electrical machines and drive systems to real-world applications, such as industrial automation, renewable energy systems, and electric vehicle propulsion.
- Work effectively in teams by: identifying individual roles and responsibilities, sharing knowledge through peer-led learning, writing technical reports and logbooks, and effective communication.

## Class Quiz

Assessment Type <sup>1</sup>: Quiz/Test

Indicative Time on Task <sup>2</sup>: 5 hours

Due: **Week 8**

Weighting: **20%**

The quiz will assess both factual knowledge and problem solving.

On successful completion you will be able to:

- Identify and demonstrate operational characteristics of electrical machines for a range of industrial applications, and their roles in green and sustainable electrical systems.
- Analyse and critically assess key aspects of DC and AC machines for a range of typical applications.
- Design, model and analyse a complete electrical machine application based on a set of specifications.
- Analyse and critically assess key aspects of design and applications of drive systems for a range of motors.

## Project Design Implementation

Assessment Type <sup>1</sup>: Design Implementation

Indicative Time on Task <sup>2</sup>: 20 hours

Due: **Weeks 13 & 14**

Weighting: **50%**

This is the major assessment of this Unit to be carried out as group project. It will consist of both individual and team assessment.

On successful completion you will be able to:

- Identify and demonstrate operational characteristics of electrical machines for a range of industrial applications, and their roles in green and sustainable electrical systems.
- Analyse and critically assess key aspects of DC and AC machines for a range of typical applications.
- Design, model and analyse a complete electrical machine application based on a set of specifications.

- Analyse and critically assess key aspects of design and applications of drive systems for a range of motors.
  - Apply knowledge of electrical machines and drive systems to real-world applications, such as industrial automation, renewable energy systems, and electric vehicle propulsion.
  - Work effectively in teams by: identifying individual roles and responsibilities, sharing knowledge through peer-led learning, writing technical reports and logbooks, and effective communication.
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<sup>1</sup> 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
- the [Writing Centre](#) for academic skills support.

<sup>2</sup> Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation

## Delivery and Resources

### 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

- **Recommended book:** [Electric Machinery Fundamentals](#) (Digital or Print), 5th Edition, by Stephen J. Chapman, McGraw Hill Int., 2012, ISBN-978-0-07-352954-7 (Digital version recommended).
  - *Note! Links will be provided to specific sections of the Digital version in iLearn for each Lectorial.*
  - *Remark: All students are expected to have access to this textbook.*
  - Support Website: <http://www.mhhe.com/chapman>
- **Supplementary book:** [Electric Machines and Drives: A First Course](#) (2012), by Ned Mohan, Wiley, ISBN: 978-1-118-21529-6 (Digital version suggested).
  - *Note! This textbook comes accompanied with slide presentations and videos by the author, Prof. Ned Mohan.*

### LECTORIALS

- Lectorials take place twice a week (Weeks 1-7) according to the Unit schedule.
  - *Note! Students are strongly encouraged to participate in at least one of the two weekly Lectorials.*
- Lectorials are a combination of traditional lecture and tutorial teaching modes and are designed to improve student engagement.
- The Lectorials are organised in a flipped classroom fashion.
- Prior to Lectorials
  - links to E-Text specific sections, brief videos and/or lecture notes are posted in iLearn each week.
  - students are expected to read these E-Text sections, try to solve any given examples, and watch any videos and/or read any posted notes prior to attending the Lectorials.
  - 'pre-class' mini quizzes to assess the basic understanding of fundamental principles in electrical machines.
- During Lectorials
  - brief discussion sessions on fundamental principles.
  - plenty of practical examples.
  - interactive problem solving involving students.

## LABORATORIES

- PC Lab activities start from Week 2 and take place once a week (Weeks 2-7) according to the Unit schedule.
  - *Note! Students must enrol in one of the available weekly Lab sessions.*

## PROJECTS

- Project activities take place from Week 8 to Week 13 according to the Unit schedule.
- The team Project is the core component of this Unit. The Projects cover practical aspects of electrical machines.
- Students are required to form teams and work on the given project topic.
  - *All Project activities are performed in teams;*

## TECHNOLOGY

- The Project work will rely on the use of PLECS software platform.
  - PLECS Standalone software can be downloaded for free from Plexim website and/or or can be used on dedicated Lab PCs.

## COMMUNICATIONS



- 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 communications regarding this Unit will be via iLearn platform.

## WEB RESOURCES

- **PLECS support:**
  - <https://plexim.com/support>
    - [PLECS videos](#)
    - [Application examples](#)
    - [Technical solutions](#)
    - [Installation help](#)

## Unit Schedule

For details, please refer to the Unit Schedule on the ELEC6201 iLearn webpage.

## Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central \(https://policies.mq.edu.au\)](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 \(https://students.mq.edu.au/support/study/policies\)](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 \(https://policies.mq.edu.au\)](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 [ask.mq.edu.au](http://ask.mq.edu.au) or if you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto: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/>

## The Writing Centre

[The Writing Centre](#) provides resources to develop your English language proficiency, academic writing, and communication skills.

- [Workshops](#)
- [Chat with a WriteWISE peer writing leader](#)
- [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 [AskMQ](#), or contact [Service Connect](#).

## IT Help

For help with University computer systems and technology, visit [http://www.mq.edu.au/about\\_us/offices\\_and\\_units/information\\_technology/help/](http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/).

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.

## Engineers Australia 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, ULO6
	1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing.	ULO1, ULO2, ULO3, ULO4, ULO5, ULO6
	1.3 In-depth understanding of specialist bodies of knowledge	ULO1, ULO2, ULO3, ULO4, ULO5, ULO6
	1.4 Discernment of knowledge development and research directions	ULO1, ULO2, ULO3, ULO4, ULO5, ULO6
	1.5 Knowledge of engineering design practice	ULO3, ULO4, ULO5, ULO6
	1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice.	ULO1, ULO2, ULO3, ULO4, ULO5
Engineering Application Ability	2.1 Application of established engineering methods to complex problem solving	ULO3, ULO5, ULO6
	2.2 Fluent application of engineering techniques, tools and resources.	ULO1, ULO2, ULO3, ULO4, ULO5, ULO6
	2.3 Application of systematic engineering synthesis and design processes.	ULO1, ULO2, ULO3, ULO4, ULO5, ULO6
	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

EA Competency Standard		Unit Learning Outcomes
	3.2 Effective oral and written communication in professional and lay domains.	ULO6
	3.3 Creative, innovative and pro-active demeanour.	ULO1, ULO2, ULO3, ULO4, ULO5, ULO6
	3.4 Professional use and management of information.	ULO1, ULO2, ULO3, ULO4, ULO5
	3.5 Orderly management of self, and professional conduct.	ULO6
	3.6 Effective team membership and team leadership	ULO6

Unit information based on version 2024.02 of the [Handbook](#)