ENEX13002 *Power Electronics*
Term 2 - 2017

Profile information current as at 17/05/2024 06:22 pm

General Information

Overview
This unit is based on your knowledge on electronics you previously studied. In this unit you will learn about power semiconductors such as Diacs, silicon controlled rectifiers (SCR), metal oxide silicon field effect transistors (MOSFET), isolated gate bipolar junction transistors (IGBT), their symbols and theory of operation and limitations. You will also learn to calculate thermal dissipation requirements of power semiconductors and to choose suitable heat sinks. You will be introduced to the concepts of alternating current (AC) to direct current (DC), DC to DC, and DC to AC circuits, pulse width modulation (PWM) control, and chopper circuits. You will also learn about different types of motors and their control including DC motor control, AC motor control and stepper motor control schemes. You will learn to simulate power electronic circuits and develop power electronics solutions industrial problems. Students enrolled in distance mode are required to attend a compulsory Residential School.

Details
Career Level: *Undergraduate*
Unit Level: *Level 3*
Credit Points: *6*
Student Contribution Band: *8*
Fraction of Full-Time Student Load: *0.125*

Pre-requisites or Co-requisites
Prerequisites: ENEX12002 Introductory Electronics OR (ENEE13018 Analogue Electronics and ENEE13020 Digital Electronics) AND (ENEX12001 Electrical Power and Machines OR ENEE12015 Electrical Power Engineering)
Important note: Students enrolled in a subsequent unit who failed their pre-requisite unit, should drop the subsequent unit before the census date or within 10 working days of Fail grade notification. Students who do not drop the unit in this timeframe cannot later drop the unit without academic and financial liability. See details in the Assessment Policy and Procedure (Higher Education Coursework).

Offerings For Term 2 - 2017
- Distance
- Mackay

Attendance Requirements
All on-campus students are expected to attend scheduled classes – in some units, these classes are identified as a mandatory (pass/fail) component and attendance is compulsory. International students, on a student visa, must maintain a full time study load and meet both attendance and academic progress requirements in each study period (satisfactory attendance for International students is defined as maintaining at least an 80% attendance record).

Residential Schools
This unit has a Compulsory Residential School for distance mode students and the details are:
Click here to see your Residential School Timetable.

Website
This unit has a website, within the Moodle system, which is available two weeks before the start of term. It is important that you visit your Moodle site throughout the term. Please visit Moodle for more information.

Class and Assessment Overview

Recommended Student Time Commitment

Each 6-credit Undergraduate unit at CQUniversity requires an overall time commitment of an average of 12.5 hours of study per week, making a total of 150 hours for the unit.

Class Timetable

Regional Campuses
Bundaberg, Cairns, Emerald, Gladstone, Mackay, Rockhampton, Townsville

Metropolitan Campuses
Adelaide, Brisbane, Melbourne, Perth, Sydney

Assessment Overview

1. **Written Assessment**
Weighting: 15%
2. **Written Assessment**
Weighting: 15%
3. **Practical and Written Assessment**
Weighting: 15%
4. **Practical and Written Assessment**
Weighting: 15%
5. **Examination**
Weighting: 40%

Assessment Grading

This is a graded unit: your overall grade will be calculated from the marks or grades for each assessment task, based on the relative weightings shown in the table above. You must obtain an overall mark for the unit of at least 50%, or an overall grade of 'pass' in order to pass the unit. If any 'pass/fail' tasks are shown in the table above they must also be completed successfully ('pass' grade). You must also meet any minimum mark requirements specified for a particular assessment task, as detailed in the 'assessment task' section (note that in some instances, the minimum mark for a task may be greater than 50%). Consult the University's Grades and Results Policy for more details of interim results and final grades.

CQUniversity Policies

All University policies are available on the CQUniversity Policy site.
You may wish to view these policies:

- Grades and Results Policy
- Assessment Policy and Procedure (Higher Education Coursework)
- Review of Grade Procedure
- Student Academic Integrity Policy and Procedure
- Monitoring Academic Progress (MAP) Policy and Procedure – Domestic Students
- Monitoring Academic Progress (MAP) Policy and Procedure – International Students
- Student Refund and Credit Balance Policy and Procedure
- Student Feedback – Compliments and Complaints Policy and Procedure
- Information and Communications Technology Acceptable Use Policy and Procedure

This list is not an exhaustive list of all University policies. The full list of University policies are available on the CQUniversity Policy site.

Unit Learning Outcomes

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

1. Explain power semiconductors and their principles of operation
2. Analyse and model the operation of alternating current (AC) to direct current (DC), DC to DC, DC to AC power converters and inverters
3. Analyse single phase and three phase rectifier circuits, inverter circuits, and different motor control schemes
4. Compare and select power electronics drive components for a mechatronic system
5. Design variable speed motor controllers for different types of electric motors and evaluate their performances
6. Solve real life problems and communicate professionally using power electronic terminology
7. Work collaboratively and autonomously and communicate professionally in presenting your solutions

Learning outcomes are linked to Engineers Australia Stage 1 Competencies and also discipline capabilities. You can find the mapping for this on the Engineering Undergraduate Course website.

Alignment of Learning Outcomes, Assessment and Graduate Attributes

— N/A Level ◦ Introductory Level • Intermediate Level • Graduate Level ◦ Professional Level ◦ Advanced Level

Alignment of Assessment Tasks to Learning Outcomes

Assessment Tasks	Learning Outcomes						
	1	2	3	4	5	6	7
1 - Written Assessment - 15%	•	•	•				
2 - Written Assessment - 15%	•	•	•				
3 - Practical and Written Assessment - 15%	•	•	•	•	•	•	•
4 - Practical and Written Assessment - 15%	•		•	•		•	•
5 - Examination - 40%	•	•	•				

Alignment of Graduate Attributes to Learning Outcomes

Graduate Attributes	Learning Outcomes						
	1	2	3	4	5	6	7
1 - Communication	•	•	•	•		•	•
2 - Problem Solving			•		•	•	•
3 - Critical Thinking	•	•	•	•	•	•	
4 - Information Literacy							
5 - Team Work					•		•
6 - Information Technology Competence	•	•	•	•	•	•	

Graduate Attributes	Learning Outcomes						
	1	2	3	4	5	6	7
7 - Cross Cultural Competence						•	
8 - Ethical practice				•			
9 - Social Innovation							
10 - Aboriginal and Torres Strait Islander Cultures							

Alignment of Assessment Tasks to Graduate Attributes

Assessment Tasks	Graduate Attributes									
	1	2	3	4	5	6	7	8	9	10
1 - Written Assessment - 15%	•	•	•			•				
2 - Written Assessment - 15%	•	•	•			•				
3 - Practical and Written Assessment - 15%	•	•	•			•		•		
4 - Practical and Written Assessment - 15%	•	•	•		•	•		•		
5 - Examination - 40%	•	•	•			•				

Textbooks and Resources

Textbooks

ENEX13002

Prescribed

Power Electronics Devices, Circuits, and Applications
4th Edition (International) (2014)
Authors: Muhammad H Rashid
Pearson Education Ltd.
Harlaw , Essex , England
ISBN: 978-0-273-76908-8
Binding: Paperback

View textbooks at the CQUniversity Bookshop

IT Resources

You will need access to the following IT resources:

- CQUniversity Student Email
- Internet
- Unit Website (Moodle)
- A Computer with Windows (7 or later) operting system and admin rights to install and run unit specific software.

Referencing Style

All submissions for this unit must use the referencing style: Harvard (author-date)
For further information, see the Assessment Tasks.

Teaching Contacts

Preethi Preethichandra Unit Coordinator
d.preethichandra@cqu.edu.au

Schedule

Week 1 - 10 Jul 2017

Module/Topic	Chapter	Events and Submissions/Topic
Introduction to Power Electronics, Power Diodes and LRC Circuits	Chapters 1 & 2	

Week 2 - 17 Jul 2017

Module/Topic	Chapter	Events and Submissions/Topic
Diode Rectifiers and Power Transistors - modelling and applications	Chapters 3 & 4	

Week 3 - 24 Jul 2017

Module/Topic	Chapter	Events and Submissions/Topic
DC-DC Converters	Chapter 5	

Week 4 - 31 Jul 2017

Module/Topic	Chapter	Events and Submissions/Topic
DC-AC Converters	Chapter 6	

Week 5 - 07 Aug 2017

Module/Topic	Chapter	Events and Submissions/Topic
Resonant Pulse Inverters and Multilevel Inverters	Chapters7 & 8	**Assignment 1** Due: Week 5 Wednesday (9 Aug 2017) 11:30 pm AEST

Vacation Week - 14 Aug 2017

Module/Topic	Chapter	Events and Submissions/Topic

Week 6 - 21 Aug 2017

Module/Topic	Chapter	Events and Submissions/Topic
Thyristors	Chapter 9	

Week 7 - 28 Aug 2017

Module/Topic	Chapter	Events and Submissions/Topic
Controlled Rectifiers	Chapter 10	

Week 8 - 04 Sep 2017

Module/Topic	Chapter	Events and Submissions/Topic
AC Voltage Controllers	Chapter 11	

Week 9 - 11 Sep 2017

Module/Topic	Chapter	Events and Submissions/Topic
DC Drives	Chapter14	**Assignment 2** Due: Week 9 Wednesday (13 Sept 2017) 11:30 pm AEST

Week 10 - 18 Sep 2017

Module/Topic	Chapter	Events and Submissions/Topic
AC Drives	Chapter15	Residential School from 18th to 20th of September.

Week 11 - 25 Sep 2017

Module/Topic	Chapter	Events and Submissions/Topic
Flexible AC Transmission Systems	Chapter 12	**Practical and Written Assessment - Lab** Due: Week 11 Monday (25 Sept 2017) 11:30 pm AEST

Week 12 - 02 Oct 2017

Module/Topic	Chapter	Events and Submissions/Topic
Power Supplies	Chapter 13	**Practical and Written Assessment - Design** Due: Week 12 Wednesday (4 Oct 2017) 11:30 pm AEST

Review/Exam Week - 09 Oct 2017

Module/Topic	Chapter	Events and Submissions/Topic

Exam Week - 16 Oct 2017

Module/Topic	Chapter	Events and Submissions/Topic

Term Specific Information

To pass this unit you must obtain an overall minimum mark of 50% and a minimum of 50% in each of the following assessment items:

1. written and practical assessment(Lab)
2. written and practical assessment(Design)
3. examination

The residential school is scheduled for 18th - 20th of September 2017.

Assessment Tasks

1 Assignment 1

Assessment Type
Written Assessment

Task Description
This assessment is based on characteristics of power semiconductors, their applications on AC to DC, DC to DC, and DC to AC power conversions. Further details will be available on unit moodle site.

Assessment Due Date
Week 5 Wednesday (9 Aug 2017) 11:30 pm AEST

Return Date to Students
Week 7 Thursday (31 Aug 2017)

Weighting
15%

Assessment Criteria
Marks will be allocated for the followings:

1. Application of theoretical fundamentals

2. Explanation of reasons to apply specific theory or method to solve a given problem where applicable

3. Correct circuit diagrams/schematics and relevant input/output waveforms

4. Correct mathematical working and correct answer

5. Neatness and format

Referencing Style

- Harvard (author-date)

Submission
Online

Learning Outcomes Assessed

- Explain power semiconductors and their principles of operation
- Analyse and model the operation of alternating current (AC) to direct current (DC), DC to DC, DC to AC power converters and inverters
- Analyse single phase and three phase rectifier circuits, inverter circuits, and different motor control schemes

Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking
- Information Technology Competence

2 Assignment 2

Assessment Type
Written Assessment

Task Description
This assignment is based on power semiconductor fundamentals and their applications where all first three learning outcomes will be assessed. Further details will be available on unit Moodle site.

Assessment Due Date
Week 9 Wednesday (13 Sept 2017) 11:30 pm AEST

Return Date to Students
Week 11 Thursday (28 Sept 2017)

Weighting
15%

Assessment Criteria
Marks will be allocated for the followings:

1. Application of theoretical fundamentals

2. Explanation of reasons to apply specific theory or method to solve a given problem where applicable

3. Correct circuit diagrams/schematics and relevant input/output waveforms

4. Correct mathematical working and correct answer

5. Neatness and format

Referencing Style

- Harvard (author-date)

Submission
Online

Learning Outcomes Assessed

- Explain power semiconductors and their principles of operation
- Analyse and model the operation of alternating current (AC) to direct current (DC), DC to DC, DC to AC power

converters and inverters
- Analyse single phase and three phase rectifier circuits, inverter circuits, and different motor control schemes

Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking
- Information Technology Competence

3 Practical and Written Assessment - Lab

Assessment Type
Practical and Written Assessment

Task Description
This assessment item is laboratory based experiments and the distance students need to come for the residential school to complete them. Further details on laboratory exercises will be available on unit Moodle site. Equipment specific instruction manuals will be available on lab computers, but they will not be available on moodle site due to copyright issues.

Assessment Due Date
Week 11 Monday (25 Sept 2017) 11:30 pm AEST

Return Date to Students
Review/Exam Week Tuesday (10 Oct 2017)

Weighting
15%

Minimum mark or grade
50%

Assessment Criteria
Marks will be allocated to :

1. Following the correct procedures during experimentation

2. Correct results

3. Analysis of results and discussion

4. Conclusions
5. Neatness and format

Referencing Style

- Harvard (author-date)

Submission
Online

Learning Outcomes Assessed

- Explain power semiconductors and their principles of operation
- Analyse and model the operation of alternating current (AC) to direct current (DC), DC to DC, DC to AC power converters and inverters
- Analyse single phase and three phase rectifier circuits, inverter circuits, and different motor control schemes
- Compare and select power electronics drive components for a mechatronic system
- Design variable speed motor controllers for different types of electric motors and evaluate their performances
- Solve real life problems and communicate professionally using power electronic terminology
- Work collaboratively and autonomously and communicate professionally in presenting your solutions

Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking
- Information Technology Competence
- Ethical practice

4 Practical and Written Assessment - Design

Assessment Type
Practical and Written Assessment

Task Description
In this assessment you will design variable speed motor controllers and analyse their performances using circuit simulation package NI Multisim or LTSpice. Further information will be available in the unit moodle site.

Assessment Due Date
Week 12 Wednesday (4 Oct 2017) 11:30 pm AEST

Return Date to Students
Exam Week Thursday (19 Oct 2017)

Weighting
15%

Minimum mark or grade
50%

Assessment Criteria
Marks will be allocated to :

1. Correct design approach and selection of correct components with appropriate ratings
2. Following the correct design procedures
3. Testing with appropriate input /output circuit models and provide waveforms
4. Correct results
5. Analysis of results and discussion
6. Conclusions

Referencing Style

- Harvard (author-date)

Submission
Online

Learning Outcomes Assessed

- Explain power semiconductors and their principles of operation
- Analyse single phase and three phase rectifier circuits, inverter circuits, and different motor control schemes
- Compare and select power electronics drive components for a mechatronic system
- Solve real life problems and communicate professionally using power electronic terminology
- Work collaboratively and autonomously and communicate professionally in presenting your solutions

Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking
- Team Work
- Information Technology Competence
- Ethical practice

Examination

Outline
Complete an invigilated examination.

Date
During the examination period at a CQUniversity examination centre.

Weighting
40%

Length
180 minutes

Minimum mark or grade
50%

Exam Conditions
Open Book.

Materials
No calculators permitted
Dictionary - non-electronic, concise, direct translation only (dictionary must not contain any notes or comments).

Academic Integrity Statement

As a CQUniversity student you are expected to act honestly in all aspects of your academic work.

Any assessable work undertaken or submitted for review or assessment must be your own work. Assessable work is any type of work you do to meet the assessment requirements in the unit, including draft work submitted for review and feedback and final work to be assessed.

When you use the ideas, words or data of others in your assessment, you must thoroughly and clearly acknowledge the source of this information by using the correct referencing style for your unit. Using others' work without proper acknowledgement may be considered a form of intellectual dishonesty.

Participating honestly, respectfully, responsibly, and fairly in your university study ensures the CQUniversity qualification you earn will be valued as a true indication of your individual academic achievement and will continue to receive the respect and recognition it deserves.

As a student, you are responsible for reading and following CQUniversity's policies, including the **Student Academic Integrity Policy and Procedure**. This policy sets out CQUniversity's expectations of you to act with integrity, examples of academic integrity breaches to avoid, the processes used to address alleged breaches of academic integrity, and potential penalties.

What is a breach of academic integrity?
A breach of academic integrity includes but is not limited to plagiarism, self-plagiarism, collusion, cheating, contract cheating, and academic misconduct. The Student Academic Integrity Policy and Procedure defines what these terms mean and gives examples.

Why is academic integrity important?
A breach of academic integrity may result in one or more penalties, including suspension or even expulsion from the University. It can also have negative implications for student visas and future enrolment at CQUniversity or elsewhere. Students who engage in contract cheating also risk being blackmailed by contract cheating services.

Where can I get assistance?
For academic advice and guidance, the Academic Learning Centre (ALC) can support you in becoming confident in completing assessments with integrity and of high standard.

What can you do to act with integrity?

Be Honest
If your assessment task is done by someone else, it would be dishonest of you to claim it as your own

Seek Help
If you are not sure about how to cite or reference in essays, reports etc, then seek help from your lecturer, the library or the Academic Learning Centre (ALC)

Produce Original Work
Originality comes from your ability to read widely, think critically, and apply your gained knowledge to address a question or problem