ELEC2070

Linear Circuits and Devices

Session 1, In person-scheduled-weekday, North Ryde 2024

School of Engineering

Contents

General Information

Unit convenor and teaching staff
Convenor
Stuart Jackson
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Contact via 9850 9137
Rm 136, 3 Management Drive
Tuesdays 11 - 1 pm

Credit points
10

Prerequisites
(PHYS1520 or PHYS143 or ENGG150) and (MATH1020 or MATH1025 or MATH136 or MATH133)

Corequisites

Co-badged status

Unit description
This unit develops the fundamentals in electric and electronic circuits and the laboratory investigation and reporting. The unit covers the key electric circuit elements and their models, and analysing circuits including these models. Topics include: linear electrical components; energy dissipation, energy storage and power transfer; Kirchhoff's laws; transient versus steady-state. Linear electrical components include voltage and current sources, resistors, capacitors, and inductors. Time domain vs frequency domain circuit analysis, and impedance concept is introduced, leading to ac circuit analysis and ac power concepts.

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: Calculate the response of circuits composed of linear circuit elements with a source of constant energy to determine all currents, voltages and power.
ULO2: Apply the method of time domain analysis of circuits composed of linear circuit elements with a source of constant energy to determine all currents, voltages and power

when an abrupt change is applied to the circuit.

ULO3: Analyse circuits composed of linear circuit elements with a source of energy with a sinusoidal time dependence to determine the circuit's response in terms of current, voltage and power.

ULO4: Apply the method of frequency domain analysis and the Laplace Transform to determine the circuit response for all applied frequencies.

ULO5: Physically construct and experimentally characterise circuits with one or more linear components

ULO6: Write concise reports summarising methodologies used and the results obtained.

General Assessment Information

Assignment Tasks

Assignment questions will be posted on iLearn at least two weeks before their submission date. Assignment solutions will be posted within one to three days after the submission date. Submissions will not be accepted after the due date. All assignments must be submitted electronically through iLearn (in pdf format). Submissions are expected to be neatly written (or typed) in a logical layout and sequence. Markers WILL NOT grade poorly organised or illegible scans or drafts. The expected workload includes preparation of final copies and clear diagrams. Re-submissions will be permitted up to the original due date. All assignments should be prepared individually by you. It is expected that students consult tutors, lecturers or other students while learning the concepts, but copying assignments from others is not accepted. Students are expected to have read and understood the academic honesty policy.

Late submissions

Online quizzes, in-class activities, or scheduled tests and exam must be undertaken at the time indicated in the unit guide. Should these activities be missed due to illness or misadventure, students may apply for Special Consideration.

Should these assessments be missed due to illness or misadventure, students should apply for Special Consideration.

Assessments not submitted by the due date will receive a mark of zero.

Grading

In order to pass this unit a student must obtain a mark of 50 or more overall or obtain a passing grade P / CR / D / HD.

Supplementary Exam

If you receive special consideration for the final exam, a supplementary exam will be scheduled. By making a special consideration application for the final exam you are declaring yourself available for a resit 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 submitting an application. Approved applicants will receive an individual notification one week prior to the exam with the exact date and time of their supplementary examination.

Assessment Tasks

Name	Weighting	Hurdle	Due
Test 1	5%	No	6/3/2024
Assignment 1	3%	No	10/3/2024
Assignment 2	3%	No	31/3/2024
Test 2	5%	No	3/4/2024
Assignment 3	3%	No	5/5/2024
Test 3	5%	No	15/5/2024
Assignment 4	3%	No	26/5/2024
Practical laboratories	23%	No	30/5/2024
Final Exam	50%	No	21/6/2024

Test 1

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 2 hours
Due: **6/3/2024**
Weighting: **5%**

20 minute test

On successful completion you will be able to:

- Calculate the response of circuits composed of linear circuit elements with a source of constant energy to determine all currents, voltages and power.

Assignment 1

Assessment Type [1]: Problem set
Indicative Time on Task [2]: 16 hours
Due: **10/3/2024**
Weighting: **3%**

This is a take home activity

On successful completion you will be able to:

- Calculate the response of circuits composed of linear circuit elements with a source of constant energy to determine all currents, voltages and power.

Assignment 2

Assessment Type [1]: Problem set
Indicative Time on Task [2]: 16 hours
Due: **31/3/2024**
Weighting: **3%**

This is a take home activity

On successful completion you will be able to:

- Apply the method of time domain analysis of circuits composed of linear circuit elements with a source of constant energy to determine all currents, voltages and power when an abrupt change is applied to the circuit.

Test 2

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 2 hours
Due: **3/4/2024**
Weighting: **5%**

20 minute test

On successful completion you will be able to:

- Apply the method of time domain analysis of circuits composed of linear circuit elements with a source of constant energy to determine all currents, voltages and power when an abrupt change is applied to the circuit.

Assignment 3

Assessment Type [1]: Problem set
Indicative Time on Task [2]: 16 hours
Due: **5/5/2024**
Weighting: **3%**

This is a take home activity

On successful completion you will be able to:

- Analyse circuits composed of linear circuit elements with a source of energy with a sinusoidal time dependence to determine the circuit's response in terms of current, voltage and power.

Test 3

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 2 hours
Due: **15/5/2024**
Weighting: **5%**

20 minute test

On successful completion you will be able to:

- Analyse circuits composed of linear circuit elements with a source of energy with a sinusoidal time dependence to determine the circuit's response in terms of current, voltage and power.

Assignment 4

Assessment Type [1]: Problem set
Indicative Time on Task [2]: 16 hours
Due: **26/5/2024**
Weighting: **3%**

This is a take home activity

On successful completion you will be able to:

- Apply the method of frequency domain analysis and the Laplace Transform to determine the circuit response for all applied frequencies.

Practical laboratories

Assessment Type [1]: Practice-based task
Indicative Time on Task [2]: 12 hours
Due: **30/5/2024**
Weighting: **23%**

These are carried weekly from Week 2 onwards

On successful completion you will be able to:

- Calculate the response of circuits composed of linear circuit elements with a source of constant energy to determine all currents, voltages and power.
- Apply the method of time domain analysis of circuits composed of linear circuit elements with a source of constant energy to determine all currents, voltages and power when an abrupt change is applied to the circuit.
- Analyse circuits composed of linear circuit elements with a source of energy with a sinusoidal time dependence to determine the circuit's response in terms of current, voltage and power.
- Apply the method of frequency domain analysis and the Laplace Transform to determine the circuit response for all applied frequencies.
- Physically construct and experimentally characterise circuits with one or more linear components
- Write concise reports summarising methodologies used and the results obtained.

Final Exam

Assessment Type [1]: Examination
Indicative Time on Task [2]: 6 hours
Due: **21/6/2024**
Weighting: **50%**

End of session final examination. This is not a hurdle.

On successful completion you will be able to:

- Calculate the response of circuits composed of linear circuit elements with a source of constant energy to determine all currents, voltages and power.
- Apply the method of time domain analysis of circuits composed of linear circuit elements with a source of constant energy to determine all currents, voltages and power when an abrupt change is applied to the circuit.
- Analyse circuits composed of linear circuit elements with a source of energy with a sinusoidal time dependence to determine the circuit's response in terms of current, voltage and power.
- Apply the method of frequency domain analysis and the Laplace Transform to determine the circuit response for all applied frequencies.
- Physically construct and experimentally characterise circuits with one or more linear components
- Write concise reports summarising methodologies used and the results obtained.

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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
- the Writing Centre 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

Delivery and Resources

The unit will comprise of 12 lectures + Exam revision lecture in Week 13 with all the review material placed on iLearn.

There is no practical class in Week 1.

On-campus actvities start in Week 1.

Could students who are unable to get back to campus on time please contact the convenor as soon as possible.

Textbooks

PRIMARY TEXT:

J. A. Svoboda, R. C. Dorf, “Introduction to Electric Circuits 9th edition,” Wiley, 2014 (or 8th edition)

SECONDARY TEXTS:

W. H. Hayt, J. E. Kennedy, S. M. Durbin, "Engineering Circuit Analysis," McGraw Hill 2007 (8th edition)

A. R. Hambley, “Electrical Engineering, Principles and Applications, International Sixth Edition,” Pearson, 2014.

Required unit materials: • The textbook J. A. Svoboda, R. C. Dorf, “Introduction to Electric Circuits 9th edition,” is the primary text. Hayt can be used to supplement the unit. • Lecture notes and worksheets for laboratory sessions (available from iLearn) • Bound logbook for all practical sessions

Technology used: Typical electronic and electrical laboratory instruments such as voltage and current sources, voltmeters, ammeters, oscilloscopes, simulation software such as MATLAB and LT Spice will be used.

Unit Schedule

Weekly Plan

A weekly plan of lectures, assignments, tests, laboratory and workshop sessions will be posted on iLearn. Students are expected to consult it and be aware of possible minor variations.

Lectures

Week 1: Introduction + Review + Fundamentals

Week 2: Power transfer + Energy storage elements (capacitors + inductors)

Week 3: Ideal operational amplifiers

Week 4: The complete response of 1st order (RL and RC) circuits

Week 5: Complete response of 2nd order (RLC) circuits

Week 6: Review of complete response of RL, RC and RLC circuits + Stability

Week 7: Frequency domain analysis for steady state sinusoidal inputs

Week 8: AC Thévenin + Norton Equivalents + Superposition + AC power

Week 9: Complex power and complex frequency

Week 10: Frequency response of simple circuits + Network Function

Week 11: Damped sinusoidal forcing function and the Laplace Transform

Week 12: Inverse Laplace Transform and circuits in the complex frequency domain

Week 13: 2017 Exam review

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 ask.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/

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/.

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.

Unit information based on version 2024.02 of the Handbook