## School of Engineering

# ELEC2320: Electrical and Electronic Circuits

Callaghan
Semester 1 - 2024

COURSE OUTLINE

# OVERVIEW

**Course Description**

This course explores the fundamental concepts of electrical circuits. Content includes mesh/loop analysis (with super meshes), nodal analysis (with super nodes), Thevenin, Norton and maximum power transfer and superposition theorem applied to circuits, circuits based on ideal operational amplifiers, simple non-linear circuits employing diodes and transistors. These include basic amplifiers, buffers and switching circuits.

**Academic Progress Requirements**

Nil

**Requisites**

To enrol in this course students must have successfully completed either ELEC1300 or ELEC1310.

**Assumed Knowledge**

It is anticipated students are studying MATH2310 concurrently or have completed it.

**Contact Hours**

**Callaghan**
**Laboratory**
Face to Face On Campus
2 hour(s) per week(s) for 13 week(s) starting Week 1

**Lecture**
Face to Face On Campus
3 hour(s) per week(s) for 13 week(s) starting Week 1

**Tutorial**
Face to Face On Campus
1 hour(s) per week(s) for 13 week(s) starting Week 1

**Unit Weighting**

10

**Workload**

Students are required to spend on average 120-140 hours of effort (contact and non-contact) including assessments per 10 unit course.

# CONTACTS

**Course Coordinator**

**Callaghan**
Dr Diego Carrasco Yanez
Diego.Carrascoyanez@newcastle.edu.au
(02) 4921 5091
Consultation: Wednesday / 12.00 noon to 2.00 pm

**Teaching Staff**

Other teaching staff will be advised on the course Canvas site.

**School Office**

**School of Engineering**
EAG02
EA Building
Callaghan
Seng-Admin@newcastle.edu.au
+61 2 4921 5798
9.00am-5.00pm (Monday to Friday)

# SYLLABUS

**Course Content**

1. Motivation for formal circuit analysis techniques. Mesh/loop analysis containing super meshes. Nodal analysis containing super nodes. Network analysis.
2. Analysis of circuits using KVL, KCL and circuit theorems (superposition, Thevenin, Norton, maximum power transfer)
3. First order passive filters, second order resonant (RLC) circuits. Energy transfer between passive elements. Q factor. Series and parallel resonances. Applications of resonant circuits. Frequency response.
4. Commonly used sensors in instrumentation circuits.
5. Ideal operational amplifier characteristics. Common and useful circuits using operational amplifiers, amplifiers and active filters.
6. Introduction to diodes, transistors and simple nonlinear circuits employing diodes and transistors including amplifiers, voltage followers, current sources and switching circuits.

**Course Learning Outcomes**

**On successful completion of this course, students will be able to:**

1. Analyse circuits using node and mesh analysis
2. Apply circuit theorems in practical work
3. Design and analyse circuits containing ideal operational amplifiers
4. Design filters and analyse circuits in the frequency domain
5. Analyse simple non-linear circuits containing discrete components such as diodes and transistors

**Course Materials**

**Required Reading:**

- Introduction to Electric Circuits - Dorf and Svoboda
  Microelectric Circuits - Sedra and Smith

# SCHEDULE

| Week | Week Begins | Topic | Learning Activity | Assessment Due |
|---|---|---|---|---|
| **1** | 26 Feb | Course introduction, review, network theorems, applications and analysis | Lecture, Tutorial | |
| **2** | 4 Mar | Network theorems, applications and analysis | Lecture, Tutorial<br>Lab - LT Spice Simulation | |
| **3** | 11 Mar | Operational amplifiers - circuits, analysis and building blocks | Lecture, Tutorial<br>Lab - Lab 1 | Online Quiz 1 |
| **4** | 18 Mar | AC circuit analysis, phasors, tuned circuits, resonance and transients | Lecture, Tutorial<br>Lab - Lab 1 | Lab 1 |
| **5** | 25 Mar | Frequency response analysis, elementary filters, Bode plots, dynamic op amp circuits | Lecture, Tutorial<br>Lab - Lab 2 | Online Quiz 2 |
| **6** | 1 Apr | Frequency response analysis, elementary filters, Bode plots, dynamic op amp circuits | Lecture, Tutorial<br>Lab - Lab 2 | Lab 2 |
| **7** | 8 Apr | Frequency response analysis, elementary filters, Bode plots, dynamic op amp circuits | Lecture, Tutorial | Online Quiz 3 |
| **Mid-Semester Recess** | | | | |
| **Mid-Semester Recess** | | | | |
| **8** | 29 Apr | Filter design | Lecture, Tutorial | |
| **9** | 6 May | Bipolar junction transistors and applications | Lecture, Tutorial<br>Lab - Lab 3 | Online Quiz 4 |
| **10** | 13 May | Bipolar junction transistors and applications | Lecture, Tutorial<br>Lab - Lab 3 | Lab 3 |
| **11** | 20 May | Diode circuits | Lecture, Tutorial<br>Lab - Project | |
| **12** | 27 May | Spare/Review | Lecture, Tutorial<br>Lab - Project | Online Quiz 5 |
| **13** | 3 Jun | Spare/Review | Lecture<br>Lab - Project | Project |
| **Examination Period** | | | | |
| **Examination Period** | | | | |

# ASSESSMENTS

This course has 4 assessments. Each assessment is described in more detail in the sections below.

| | Assessment Name | Due Date | Involvement | Weighting | Learning Outcomes |
|---|---|---|---|---|---|
| **1** | Laboratories | See course schedule | Pair | 15% | 1, 2, 3, 4, 5 |
| **2** | Design Project | See course schedule | Pair | 20% | 1, 2, 3, 4, 5 |
| **3** | Quiz | See course schedule | Individual | 15% | 1, 2, 5 |
| **4** | Formal Examination | Exam period | Individual | 50% | 1, 2, 3, 4, 5 |

**Late Submissions** The mark for an assessment item submitted after the designated time on the due date, without an approved extension of time, will be reduced by 10% of the possible maximum mark for that assessment item for each day or part day that the assessment item is late. Note: this applies equally to week and weekend days.

## Assessment 1 - Laboratories

| | |
|---|---|
| **Assessment Type** | Tutorial / Laboratory Exercises |
| **Purpose** | Gain practical experience on the topics discussed in the course, with particular emphasis on operational amplifier and transistor circuits. |
| **Description** | 3 Labs - each lab contributes 5% toward the final grade |
| **Weighting** | 15% |
| **Length** | See course schedule |
| **Due Date** | See course schedule |
| **Submission Method** | In Class<br>Demonstration to lab tutor |
| **Assessment Criteria** | Available in the lab marking rubrics on Canvas |
| **Return Method** | In Class |
| **Feedback Provided** | In Class |
| **Opportunity to Reattempt** | Students WILL NOT be given the opportunity to reattempt this assessment. |

## Assessment 2 - Design Project

| | |
|---|---|
| **Assessment Type** | Project |
| **Purpose** | Design and prototype practical circuits using knowledge gained throughout the course |
| **Description** | |
| **Weighting** | 20% |
| **Length** | See course schedule |
| **Due Date** | See course schedule |
| **Submission Method** | In Class<br>Demonstration to lab tutor |
| **Assessment Criteria** | Available in the project marking rubric on Canvas |
| **Return Method** | In Class |
| **Feedback Provided** | In Class |
| **Opportunity to Reattempt** | Students WILL NOT be given the opportunity to reattempt this assessment. |

## Assessment 3 - Quiz

| | |
|---|---|
| **Assessment Type** | Quiz |
| **Purpose** | Allows students to test their understanding of the topics covered in the lectures. |
| **Description** | 5 online individual quizzes<br>The links to the quizzes will be made available under the assessment folder in Canvas<br>Each quiz will contribute 3% toward the final grade |
| **Weighting** | 15% |
| **Due Date** | See course schedule |
| **Submission Method** | Online |
| **Assessment Criteria** | |
| **Return Method** | Online |
| **Feedback Provided** | Online |
| **Opportunity to Reattempt** | Students WILL NOT be given the opportunity to reattempt this assessment. |

## Assessment 4 - Formal Examination

| | |
|---|---|
| **Assessment Type** | Formal Examination |
| **Description** | Examine the students knowledge on the contents of the course |
| **Weighting** | 50% |
| **Due Date** | Exam period |
| **Submission Method** | Formal Exam |
| **Assessment Criteria** | |
| **Return Method** | Not Returned |
| **Feedback Provided** | No Feedback |
| **Opportunity to Reattempt** | Students WILL NOT be given the opportunity to reattempt this assessment. |

# ADDITIONAL INFORMATION

**Grading Scheme**

This course is graded as follows:

| Range of Marks | Grade | Description |
|---|---|---|
| 85-100 | High Distinction (HD) | Outstanding standard indicating comprehensive knowledge and understanding of the relevant materials; demonstration of an outstanding level of academic achievement; mastery of skills*; and achievement of all assessment objectives. |
| 75-84 | Distinction (D) | Excellent standard indicating a very high level of knowledge and understanding of the relevant materials; demonstration of a very high level of academic ability; sound development of skills*; and achievement of all assessment objectives. |
| 65-74 | Credit (C) | Good standard indicating a high level of knowledge and understanding of the relevant materials; demonstration of a high level of academic achievement; reasonable development of skills*; and achievement of all learning outcomes. |
| 50-64 | Pass (P) | Satisfactory standard indicating an adequate knowledge and understanding of the relevant materials; demonstration of an adequate level of academic achievement; satisfactory development of skills*; and achievement of all learning outcomes. |
| 0-49 | Fail (FF) | Failure to satisfactorily achieve learning outcomes. If all compulsory course components are not completed the mark will be zero. A fail grade may also be awarded following disciplinary action. |

*Skills are those identified for the purposes of assessment task(s).

**Communication Methods**

Communication methods used in this course include:

- Canvas Course Site: Students will receive communications via the posting of content or announcements on the Canvas course site.
- Face to Face: Communication will be provided via face to face meetings or supervision.

**Course Evaluation**

Each year feedback is sought from students and other stakeholders about the courses offered in the University for the purposes of identifying areas of excellence and potential improvement.

**Oral Interviews (Vivas)**

As part of the evaluation process of any assessment item in this course an oral examination (viva) may be conducted. The purpose of the oral examination is to verify the authorship of the material submitted in response to the assessment task. The oral examination will be conducted in accordance with the principles set out in the Oral Examination (viva) Procedure. In cases where the oral examination reveals the assessment item may not be the student's own work the case will be dealt with under the Student Conduct Rule.

**Academic Misconduct**

All students are required to meet the academic integrity standards of the University. These standards reinforce the importance of integrity and honesty in an academic environment. Academic Integrity policies apply to all students of the University in all modes of study and in all locations. For the Student Academic Integrity Policy, refer to https://policies.newcastle.edu.au/document/view-current.php?id=35.

**Adverse Circumstances**

The University acknowledges the right of students to seek consideration for the impact of allowable adverse circumstances that may affect their performance in assessment item(s). Applications for special consideration due to adverse circumstances will be made using the online Adverse Circumstances system where:

1. the assessment item is a major assessment item; or
2. the assessment item is a minor assessment item and the Course Co-ordinator has specified in the Course Outline that students may apply the online Adverse Circumstances system;
3. you are requesting a change of placement; or
4. the course has a compulsory attendance requirement.

Before applying you must refer to the Adverse Circumstance Affecting Assessment Items Procedure available at:
https://policies.newcastle.edu.au/document/view-current.php?id=236

**Important Policy Information**

The Help button in the Canvas Navigation menu contains helpful information for using the Learning Management System. Students should familiarise themselves with the policies and procedures at https://www.newcastle.edu.au/current-students/respect-at-uni/policies-and-procedures that support a safe and respectful environment at the University.

*This course outline was approved by the Head of School on 14.02.2024. No alteration of this course outline is permitted without Head of School approval. If a change is approved, students will be notified and an amended course outline will be provided in the same manner as the original.*

**Graduate Profile Statements – ELEC2320 – S1 2024**

This course builds students' capacity in the following University of Newcastle Bachelor of Engineering Graduate Profile Statements (based on 2011 Engineers Australia revised Stage 1 Competency Standards for Professional Engineers):

| UON Att. | University of Newcastle Bachelor of Engineering Graduate Profile Statements/ Engineers Australia Stage 1 competency statements | Taught | Practised | Assessed | Skill Level (1-4) |
|---|---|---|---|---|---|
| | **Professional Attributes** | | | | |
| 11 | 3.1. Ethical conduct and professional accountability | | | | |
| 12 | 3.2. Effective oral and written communication in professional and lay domains. | | x | x | 2 |
| 13 | 3.3. Creative, innovative and pro-active demeanour. | | x | x | 2 |
| 14 | 3.4. Professional use and management of information. | | | | |
| 15 | 3.5. Orderly management of self, and professional conduct. | | | | |
| 16 | 3.6. Effective team membership and team leadership. | | | | |
| | **Engineering Ability** | | | | |
| 7 | 2.1. Application of established engineering methods to complex engineering problem solving. | x | x | x | 2-3 |
| 8 | 2.2. Fluent application of engineering techniques, tools and resources. | x | x | x | 2-3 |
| 9 | 2.3. Application of systematic engineering synthesis and design processes. | | x | x | 2-3 |
| 10 | 2.4. Application of systematic approaches to the conduct and management of engineering projects. | | | | |
| | **Knowledge Base** | | | | |
| 1 | 1.1. Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline. | x | x | x | 3 |
| 2 | 1.2. Conceptual understanding of the, mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline. | x | x | x | 2 |
| 3 | 1.3. In-depth understanding of specialist bodies of knowledge within the engineering discipline. | x | x | x | 2 |
| 4 | 1.4. Discernment of knowledge development and research directions within the engineering discipline. | | x | x | 3 |
| 5 | 1.5. Knowledge of contextual factors impacting the engineering discipline. | | | | |
| 6 | 1.6. Understanding of the scope, principles, norms, accountabilities and bounds of contemporary engineering practice in the specific discipline. | | | | |