

**ENGPHYS 2E04**  
**Analog and Digital Circuits**  
Undergraduate Studies  
Fall 2024  
Course Outline

**CALENDAR/COURSE DESCRIPTION**

Design and analysis of analog and digital electrical circuits - component analysis, circuit analysis and theorems, binary numbers, Boolean analysis and digital circuit design.

Three lectures, one lab (three hours); first term

**PRE-REQUISITES AND ANTI-REQUISITES**

Prerequisite(s): PHYSICS 1E03, credit or registration in MATH 2Z03, and registration in an Engineering program  
Antirequisite(s): N/A

**INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION**

**Dr. Jon Bradley**  
JHE A413  
[jbradley@mcmaster.ca](mailto:jbradley@mcmaster.ca)  
ext. 24013

**Office Hours:**  
See course website

**LAB SUPERVISOR OFFICE HOURS AND CONTACT INFORMATION**

**Catherine Luck**  
BSB B102  
[luckc@mcmaster.ca](mailto:luckc@mcmaster.ca)  
ext. 24935

**Office Hours:**  
See course website

**TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION**

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**Office Hours:**  
See course website

**COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION**

<http://avenue.mcmaster.ca/>

It is the students' responsibility to regularly check the course web page (Avenue to Learn) for updates and announcements.

Microsoft Teams will be used for questions, communications and discussions.

### COURSE INTENDED LEARNING OUTCOMES

By the end of this course, students should be able to:

- Analyze analog and digital electrical circuits;
- Simulate analog and digital circuits using software-based tools;
- Design, implement and test analog and digital electrical circuits using simulation software and laboratory measurement equipment.
- Perform circuit measurements taking into account the specifications of electrical measuring equipment.

### MATERIALS AND FEES

#### Computer:

Students should have a laptop or Desktop capable of simultaneously running an equation solver (e.g., Maple, MATLAB, Python, etc.), a circuit solver (e.g., Multisim, SPICE, etc.) and Microsoft Word (Windows machines are recommended, price point of \$300 or up should be fine). You are required to use this for the labs.

#### Software:

MS Word (2007 or newer)

MS Teams (current version)

NI Multisim simulation software (ideally version 14 or newer)

Maple (Version 15 or higher) or another computer algebra system is recommended.

#### Hardware:

This year you'll use the in-lab equipment to complete the lab exercises, but you will need to bring your laptop to use Multisim in the lab and compare.

#### Other Materials:

Course notes available free online.

### COURSE FORMAT AND EXPECTATIONS

The course is organized as follows:

- 3 classroom-based lectures per week
- 1 in-person laboratory session per week
- 2 practice laboratories
- 7 laboratories including reports and demos
- 1 design project
- 3 self-reflections

Course policies:

- It is the students' responsibility to regularly check the course web page (Avenue to Learn) and lecture notes for updates and announcements.
- Students are required to obtain and maintain a McMaster e-mail account for timely communications between the instructor and the students.
- Students are expected to behave in a way that does not disrupt the learning experience of your peers in lectures and laboratories.

### COURSE SCHEDULE

Week	Topic	Lab
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1	1. DC resistive network analysis	-
2	1. DC resistive network analysis	DC practice lab
3	2. AC steady-state network analysis	Lab 1
4	2. AC steady-state network analysis	AC practice lab
5	3. Transient analysis	Lab 2 + reflection 1
6	4. Frequency response & filters	Lab 3
7	Midterm recess	-
8	5. AC power	Lab 4
9	6. Digital logic analysis & design	Lab 5 + reflection 2
10	6. Digital logic analysis & design	Lab 6a
11	7. Sequential logic analysis & finite state machines	Lab 6b
12	X. Design project: Sequential logic design	Lab 7
13	X. Design project: Sequential logic design	Design project + reflection 3
14	X. Design project: Sequential logic design	Design project + reflection 3

**ASSESSMENT**

Component	Weight
Analog	48%
Labs 1 & 2	12% (6% each)
Labs 3–5	36% (12% each)
Digital	49%
Labs 6 & 7	20% (10% each)
Digital design project	29%
Self-reflections	3% (1% each)
Total	100%

**ACCREDITATION LEARNING OUTCOMES**

The Learning Outcomes defined in this section are measured for Accreditation purposes only and will not be directly taken into consideration in determining a student's grade in the course.

Course Outcomes	Indicators
<b>In analog part of the course, is able to make physical measures of circuit outputs including acceptable understanding of error analysis</b>	3.1 Selects appropriately from relevant knowledge base to plan appropriate data collection methods and analysis strategies.
<b>In analog labs, is able to reconcile tri-solve results for circuits in the analysis sections</b>	3.2 Synthesizes the results of an investigation to reach valid conclusions.
<b>Can successfully complete the digital design project including evaluating alternative approaches and implementing an optimized one</b>	4.3 Develops models/prototypes; tests, evaluates, and iterates as appropriate.

For more information on Accreditation, please visit: <https://www.engineerscanada.ca>

**EQUITY, DIVERSITY, AND INCLUSION**

Every registered student belongs in this course. Diversity of backgrounds and experiences is expected and welcome. You can expect your Instructor to be respectful of this diversity in all aspects of the course, and the same is expected of you.

The Department of Engineering Physics is committed to creating an environment in which students of all genders, cultures, ethnicities, races, sexual orientations, abilities, and socioeconomic backgrounds have equal access to education and are welcomed and treated fairly. If you have any concerns regarding inclusion in our Department, in particular if you or one of your peers is experiencing harassment or discrimination, you are encouraged to contact the Chair, Associate Undergraduate Chair, Academic Advisor or to contact the [Equity and Inclusion Office](#).

#### PHYSICAL AND MENTAL HEALTH

For a list of McMaster University's resources, please refer to the [Student Wellness Centre](#).

#### ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. **It is your responsibility to understand what constitutes academic dishonesty.**

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university. For information on the various types of academic dishonesty please refer to the [Academic Integrity Policy](https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/), located at <https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/>

The following illustrates only three forms of academic dishonesty:

1. plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. improper collaboration in group work.
3. copying or using unauthorized aids in tests and examinations.

#### COURSES WITH AN ON-LINE ELEMENT

McMaster is committed to an inclusive and respectful community. These principles and expectations extend to online activities including electronic chat groups, video calls and other learning platforms.

**Some courses may** use on-line elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure, please discuss this with the course instructor.

#### CONDUCT EXPECTATIONS

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the [Code of Student Rights & Responsibilities](#) (the “Code”). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, **whether in person or online.**

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students’ access to these platforms.

#### ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES

Students with disabilities who require academic accommodation must contact [Student Accessibility Services](#) (SAS) at 905-525-9140 ext. 28652 or [sas@mcmaster.ca](mailto:sas@mcmaster.ca) to make arrangements with a Program Coordinator. For further information, consult McMaster University’s [Academic Accommodation of Students with Disabilities](#) policy.

#### COURSE POLICY ON MISSED WORK, EXTENSIONS, AND LATE PENALTIES

1. It is the students’ responsibility to regularly check the course webpage (ex. Avenue to Learn) for updates and announcements.
2. Under normal circumstances, missing the 23:59 deadline for submitting a regular lab report for 2E04 on the day you presented the lab correspond to a reduction in grade on the deliverable of 10% + an additional 10% per additional day past the deadline the work is submitted. Missing the lab presentation without being approved to present it in the following week (or missing the following week presentation after the extension has been granted) will result in a grade of 0 on that lab.
3. The Design Project writeup has the more severe late penalty of a multiplicative grade deduction equal to [how late it was submitted] / [10 hours], with a maximum penalty of 100% [relative] deduction at 10 hours past the due date.

#### SUBMISSION OF REQUEST FOR RELIEF FOR MISSED ACADEMIC WORK

In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar “Requests for Relief for Missed Academic Term Work”.

1. **Relief for missed academic work worth less than 25% of the final grade resulting from medical or personal situations lasting up to three calendar days:**
  - Use the [McMaster Student Absence Form](#) (MSAF) on-line self-reporting tool. No further documentation is required.
  - Students may submit requests for relief using the MSAF once per term.
  - An automated email will be sent to the course instructor, who will determine the appropriate relief. Students must immediately follow up with their instructors. Failure to do so may negate the opportunity for relief.
  - The MSAF cannot be used to meet a religious obligation or to celebrate an important religious holiday.
  - The MSAF cannot be used for academic work that has already been completed attempted.
  - An MSAF applies only to work that is due within the period for which the MSAF applies, i.e. the 3-day period that is specified in the MSAF; however, all work due in that period can be covered by one MSAF.
  - The MSAF cannot be used to apply for relief for any final examination or its equivalent. See *Petitions for Special Consideration* above.

2. **For medical or personal situations lasting more than three calendar days, and/or for missed academic work worth 25% or more of the final grade, and/or for any request for relief in a term where the MSAF has been used previously in that term:**
- Students must report to their Faculty Office to discuss their situation and will be required to provide appropriate **supporting documentation**.
  - If warranted, the Faculty Office will approve the absence, and the instructor will determine appropriate relief.

#### ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the [RISO](#) policy. Students should submit their request to their Faculty Office **normally within 10 working days** of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

#### COPYRIGHT AND RECORDING

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, **including lectures** by University instructors

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

#### EXTREME CIRCUMSTANCES

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.