Engineering Physics
ENGPHYS 2E04
Analog and Digital Circuits
Undergraduate Studies
Fall 2025
Course Outline

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

Dr. Jon Bradley
JHE A413
jbradley@cmaster.ca
ext. 24013

Office Hours:
By appointment

LAB SUPERVISOR OFFICE HOURS AND CONTACT INFORMATION

Catherine Luck
BSB B102
luckc@mcmaster.ca
ext. 24935

Office Hours:
See course website

TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

TA List and Email Addresses:
See course website

Office Hours:
See course website

COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

The official means of communication with students is via the course webpage on Avenue to Learn.
It is the students' responsibility to regularly check the course webpage for updates and announcements.

CLASS FORMAT

Course Dates: 09/02/2025 - 12/04/2024
Units: 4
Course Delivery Mode: All classes are in-person.
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
Prerequisite(s): PHYSICS 1E03, credit or registration in MATH 2Z03, and registration in an Engineering program
Antirequisite(s): N/A

The course is scheduled as follows:

- C01: lecture Tuesday 9:30 – 10:20 am see Mosaic or Avenue for location
- C01: lecture Wednesday 9:30 – 10:20 am see Mosaic or Avenue for location
- C01: lecture Friday 9:30 – 10:20 am see Mosaic or Avenue for location
- L01: lab Monday 2:30 – 5:20 pm see Mosaic or Avenue for location

• L02: lab	Tuesday	2:30 – 5:20 pm	see Mosaic or Avenue for location
• L03: lab	Wednesday	2:30 – 5:20 pm	see Mosaic or Avenue for location
• L04: lab	Thursday	2:30 – 5:20 pm	see Mosaic or Avenue for location
• L05: lab	Friday	2:30 – 5:20 pm	see Mosaic or Avenue for location

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.

ENGINEERING ACCREDITATION: GRADUATE ATTRIBUTES AND LEARNING OUTCOMES

The Canadian Engineering Accreditation Board (CEAB) is a division of Engineers Canada and is responsible for accrediting undergraduate engineering programs across Canada. Accreditation by the CEAB ensures that the engineering programs meet a national standard of quality and cover essential educational requirements. Graduate Attributes are a set of qualities and skills that the CEAB expects engineering graduates to possess. These attributes are a benchmark for the learning outcomes of accredited engineering programs. This section lists the Graduate Attribute Indicators associated with some of the Learning Outcomes in this course.

The Graduate Attributes 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.

Outcomes	Indicators
In the analog part of the course, the student is able to make physical measures of circuit outputs including acceptable understanding of error analysis.	3.1 Selects appropriately from relevant knowledge base to plan appropriate data collection methods and analysis strategies.
In the digital part of the course, the student is able to contribute actively and fairly to the team part of the design project.	6.1 Actively contributes to the planning and execution of a team project.
The student is able to write a clear and well-organized lab report.	7.2 Composes an effective written document for the intended audience.

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

LAB INFORMATION

Labs overview:

- Each lab topic has associated lectures, course notes, and example practice problems that guide you through the material.
- Students explore all topics using a "three-pronged" approach to electronics problem solving; students **"Tri-Solve"** all electronics problems by:
  1. Completing an Analytical solution (with the help of computer algebra systems),

2. Simulating them (using NI Multisim software), and
3. Physically measuring them (by assembling the circuits on a breadboard, then powering them and measuring their results in the lab).

- The last lab will be a design lab and final presentation

Lab format and expectations:

1. Preparation:
- Students work through all the topic's course notes and practice problems.

2. Lab completion and submission:
- Then…receive a variation of the sample lab circuit for that week which emphasizes the topics and is challenging, and Tri-Solve it
- Prepare a writeup documenting and comparing the analytical, simulated and physical circuit
- Build, test and demo the working physical circuit during the lab period
- Submit your writeup

Lab policies:

- Your final form of the writeup is due at 23:59PM on the day before your next lab session (but besides the physical part, should be completed prior to going into the lab). Lab writeups will be submitted to the appropriate Avenue to Learn dropbox.
- You'll work in Teams of 2 to complete the physical lab, but you are each responsible for doing and understanding all parts of the solution, building, measuring, and demonstrating your own circuit, and submitting your own writeup.
- You will be expected to individually demo & explain aspects of the analytical and multisim solutions and physical measurements during your lab session to obtain the full mark your report. Students may also be asked questions related to the lecture content and course notes during the demo.
- If the circuit fails to work (can't be measured) due to equipment failure or otherwise, students can still get credit by documenting their attempts to debug the issue and submitting that as a detailed writeup as well. If given sufficient time, the department lab techs can also replace broken equipment.

LAB SAFETY

Lab safety will be covered by the lab instructor during the lab sessions. Important safety information will also be included in the lab manuals and posted on Avenue to Learn. Students are expected to listen to and read all safety information carefully and follow all safety instructions while completing the lab.

COURSE SCHEDULE

A weekly breakdown of the course schedule

Date/Week	Topic/Reading	Lab
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 & logic gates	Lab 5 + reflection 2

10	7. Digital logic design & K-maps	Lab 6
11	8. Sequential logic analysis & finite state machines	Lab 7
12	X. Design project: Sequential logic design	Lab 8
13	X. Design project: Sequential logic design	Design project + reflection 3
14	X. Design project: Sequential logic design	Design project + reflection 3

This lecture schedule is based upon current university and public health guidelines and may be subject to changes during the term. Any changes to the schedule or course delivery will be communicated on the course announcements section on Avenue to Learn. Please check the announcements prior to attending class.

REQUIRED/OPTIONAL MATERIALS AND FEES

Required Texts:
N/A

Recommended Additional Texts:
N/A

Calculator:
Only the McMaster Standard Calculator will be permitted in tests and examinations. This is available at the Campus Store.

Other Materials:
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
- MS Teams
- NI Multisim simulation software (ideally version 14 or newer)
- Maple (Version 15 or higher) or another computer algebra system (e.g. MATLAB) is recommended.

Hardware:

- Students will 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 your simulated and measured circuit results.

Course notes:

- Course notes available free online.

COURSE ASSESSMENT DETAILS

Component	Weight
Analog	48%
Labs 1 & 2	12% (6% each)
Labs 3–5	36% (12% each)
Digital	49%

Labs 6 & 7	12% (6% each)
Lab 8	12%
Digital design project	25%
Self-reflections	3% (1% each)
Total	100%

GRADING SCALE

The McMaster 12 Point Grading Scale

Grade	Equivalent Grade Point	Equivalent Percentages
A+	12	90-100
A	11	85-89
A-	10	80-84
B+	9	77-79
B	8	73-76
B-	7	70-72
C+	6	67-69
C	5	63-66
C-	4	60-62
D+	3	57-59
D	2	53-56
D-	1	50-52
F	0	0-49

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 corresponds 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 regular lab session and demo (without an approved MSAF and rescheduled lab and demo time) 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.

MSAF policy:

- Students are required to obtain and MSAF for extensions. Don't come to me (the instructor) to request an extension.
- The standard McMaster policy on MSAFs will be followed. Please see the course outline and visit the link below for details:
  https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/
- In the event you submit an MSAF, notify me (the instructor), your TA and the lab instructor of the MSAF and confirm the new lab presentation day/time.
- Under normal circumstances, the presentation will occur in the next possible lab session outside the MSAF window, and the writeup will be due as usual at 11:59PM 1 week after the presentation.

GENERATIVE AI

Students may use generative AI for editing/translating/outlining/brainstorming/revising their work throughout the course so long as the use of generative AI is referenced and cited following citation instructions given on Avenue to Learn. Use of generative AI outside the stated use of editing/translating/outlining/brainstorming/revising their work with citation will constitute academic dishonesty. It is the student's responsibility to be clear on the limitations for use and to be clear on the expectations for citation and reference and to do so appropriately. Students must tri-solve labs and prepare their assignments themselves and be able to explain the work they submit.

APPROVED ADVISORY STATEMENTS

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 and the Faculty of Engineering are 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.

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*, 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.

AUTHENTICITY / PLAGIARISM DETECTION

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. **All submitted work is subject to normal verification that standards of academic integrity have been upheld** (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com please go to www.mcmaster.ca/academicintegrity.

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.

ONLINE PROCTORING

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

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 to make arrangements with a Program Coordinator. For further information, consult McMaster University's *Academic Accommodation of Students with Disabilities* policy.

ACADEMIC ADVISING

Academic Advisors are available to assist you with any problems or questions you may have. This includes course selections, changes to your enrolment, McMaster Student Absence Form (MSAF), Religious, Indigenous, or Spiritual Observances (RISO) forms, exams, taking courses at another university (for credit at McMaster), Petitions for Special Consideration, and much more. Below is the contact information for the Office of the Associate Dean (Academic) in the Faculty of Engineering:

JHE-Hatch 301
https://www.eng.mcmaster.ca/programs/academic-advising
(905) 525-9140 ext. 24646

PHYSICAL AND MENTAL HEALTH

For a list of McMaster University's resources, please refer to the Student Wellness Centre.

REQUESTS 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". An abbreviated version is provided below.

The University recognizes that students periodically require relief from academic work due to extenuating circumstances. Students seeking relief for missed academic term work are expected to read the ***McMaster Student Absence Form Policy***. The Policy aims to manage these requests by taking into account the needs and obligations of students, instructors and administrators. It is the prerogative of the instructor of the course to determine the appropriate relief for missed term work in their course. Any concerns regarding the granting of relief should be directed to the Faculty Office.

1. **Relief for missed academic work worth less than 25% of the final grade resulting from medical or personal situations lasting up to three (3) 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 or 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 (3) 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.