Engineering Physics
ENGPHYS 3BB3
Electronics II: Embedding and Programming a Micro-Controller
Undergraduate Studies
Winter 2026
Course Outline

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

Dr. Adriaan Buijs
JHE A325
buijsa@mcmaster.ca
ext. 24925

Office Hours:
By appointment

TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

Reza Islam
Islamm42@mcmaster.ca
Rihannon Lee
leer72@mcmaster.ca
Christopher Natale
natalc@mcmaster.ca
Mikayala Woodward
woodwm1@mcmaster.ca

Office Hours:
By appointment

COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

The official means of communication with students is via the course webpage on Avenue to Learn and through email from Avenue to Learn.
It is the students' responsibility to regularly check the course webpage for updates and announcements.
Emails are assumed to be read.

CLASS FORMAT

Course Dates: 2026/01/06 – 2026/04/07
Units: 3
Course Delivery Mode: All classes are in-person.
Course Description: Design and synthesis project in electronics, based on the material presented in ENGPHYS 3BA3. Hands-on experience with microcontrollers and their programming will result in an 'intelligent product', in particular a PID-controlled process. The theory of PID control and digital filtering will also be discussed.
Prerequisite(s): Completion of the labs in ENGPHYS 3BA3, or ENGPHYS 3BA4 or PHYSICS 3BA3
Antirequisite(s): PHYSICS 3B06, 3BB3.

See Mosaic for scheduling and location of the lectures and the labs.
Lectures are not being recorded.
In case of disagreement, the mosaic version supersedes this outline.

COURSE INTENDED LEARNING OUTCOMES

Upon successful completion of the course, a student will:

1. Be able to program a microcontroller and interface it with analog electronic components.
2. Understand the functioning of a microcontroller and the assembly language.

3. Have followed a design process and created a device in which analog electronics is driven by a microcontroller.
4. Have designed and built a process under PID control.
5. Have worked in a small team.
6. Have communicated his/her work in written form.
7. Have presented his/her work to the class and the instructors

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 no good reason and will not be directly taken into consideration in determining a student's grade in the course.

Outcomes	Indicators
Recognizes and follows an engineering design process.(This means an iterative activity that might include recognizing the goal, specifying the constraints and desired outcomes, proposing solutions, evaluating alternatives, deciding on a solution, and implementing.)	4.1
Recognizes and follows engineering design principles including appropriate consideration of environmental, social and economic aspects as well as health and safety issues.	4.2
Proposes solutions to open-ended problems.	4.3
Manages time and processes effectively, prioritizing competing demands to achieve personal and team goals and objectives.	6.1

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

COURSE SCHEDULE - LABS

Date / Week	Topic	Readings
Week 1	Introduction to Microcontrollers, C and assembler (LEDs on and off)	Lab manual
Week 2	Timer module	Lab manual
Week 3	Serial Communication	Lab manual
Week 4	Interrupts	Lab manual
Week 5	ADC	Lab manual
Week 6	Reading Week	
Week 7	Project Prep	Lab manual
Week 8	Project – Week 1	
Week 9	Project – Week 2	

Week 10	Project – Week 3	
Week 11	Project – Week 4	
Week 12/13	Project Demonstration	

LAB SAFETY

Lab safety will be discussed at the first lab.

COURSE SCHEDULE - LECTURES

Date / Week	Topic	Readings
Week 1	Basics of C Programming and introduction to the MSP430	Lecture notes
Week 2	Timer Module	Lecture notes
Week 3	Serial Communication	Lecture notes
Week 4	Interrupts	Lecture notes
Week 5	ADC	Lecture notes
Week 6	Reading Week	
Week 7	Serial Interface	Lecture notes
Week 8	Introduction to PID	Lecture notes
Week 9	Theory and Examples of PID	Lecture notes
Week 10	Introduction to digital filters	Lecture notes
Week 10–12	Project Review and Progress	Lecture notes

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:

- There are no required texts for the microcontroller.
- It is recommended to read the various guides and data sheets that are provided on ATL;
- For engineering ethics read: https://www.ontario.ca/laws/regulation/900941#BK93 .

Calculator:

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

Other Materials:

- The Texas Instruments MSP430 LaunchPad development kit need to be purchased. Instructions on how to obtain these will be posted on Avenue to Learn. (cost ca. $12)
- Software to be downloaded ahead of time: Texas Instruments' Code Composer Studio IDE. Further instructions will be posted on Avenue to Learn.

- A Student version of National Instrument's MultiSim, version higher than 10.0. (available from https://www.studica.ca/en/); should be used for the analog component of the design project. (cost ca. $100)
- Other lab equipment (such as power supplies and oscilloscopes) and consumables (such as resistors, capacitors, and jumper wires) will be provided in the lab.

COURSE ASSESSMENT DETAILS

Component	Weight (%)	Comment
Pre-Lab Quiz	10	Submission due before respective labs
Lab exercises	30	Evaluated by presence, logbook submission, and in-person evaluation
Lab 6 short report	10	
Performance of final project	20	Demo to TA and instructor
Report on final project	15	
Exam(s)	15	Max(Final,0.2xMidterm+0.8xFinal)
Total	100	

Note that a passing mark in the Final Exam is NOT required for passing this course.

GRADING SCALE (WHY DO WE NEED 3 SCALES?)

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

MSAF policy:

- An MSAF for a missed quiz will automatically allocate the missed grade to the total quiz grade component.
- An MSAF for a missed lab/report will automatically lead to a 1-week extension for that assignment, but it still needs to be performed/submitted.

GENERATIVE ARTIFICIAL INTELLIGENCE

The use of artificial intelligence (AI) such as ChatGPT is permitted and encouraged for this course.

Limitations and exceptions:

- AI may not be used during timed quizzes and exams.
- AI may not be used during lab time and in preparing the log of the lab.

Students will receive homework exercises. These do not need to be submitted and will not be marked. Students are free to perform these exercises with the assistance of AI. Some of these exercises may appear in the mid-term or final examination, when they need to be solved without the use of AI.

Students may use AI in the preparation of their lab- and project report. AI may be used for language, wording, spelling, preparation of tables and figures. Data used in the report must be the student's own. Verbatim copying of material generated by AI is not permitted. Given these options, the reports are expected to be of high quality.

APPROVED ADVISORY STATEMENTS

EQUITY, DIVERSITY, AND INCLUSION

Every student registered for this course is welcome. Diversity of backgrounds and experiences is expected and welcomed. 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.