

ENG PHYS 3BB3
Electronics II
Winter 2018/19
Course Outline

CALENDAR/COURSE DESCRIPTION

Design and synthesis project in electronics, based on the material presented in ENGPYHS 3BA3. Hands-on experience with microcontrollers and their programming will result in an 'intelligent product', in particular a PID-controlled process.

PRE-REQUISITES AND ANTI-REQUISITES

Prerequisite(s): ENGPYHS 3BA3 or PHYSICS 3BA3
Antirequisite(s): PHYSICS 3B06, 3BB3

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

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Office Hours:
By appointment

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TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

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Office Hours:
By appointment

COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

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

COURSE OBJECTIVES

Upon successful completion of the course, a student will:

1. Be able to program a microcontroller and interface it with analog electronic components.
2. Have followed a design process and created a device in which analog electronics is driven by a microcontroller.
3. Have designed and built a process under PID control.
4. Have worked in a small team.

5. Have communicated his/her work in written form.
6. Have presented his/her work to the class and the instructors.

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 the engineering design process, students should read chapters 3, 7, 11 and 12 of http://itll.colorado.edu/courses_workshops/geen_1400/resources/textbook/ ;
- For engineering ethics: http://www.peo.on.ca/index.php?ci_id=1815&la_id=1 .

Other Materials:

- The Texas Instruments MSP430 LaunchPad development kit, approx. retail value \$15. This kit may be purchased in the lab for \$20. Students are encouraged to buy this kit in advance of the course, and to install the software on their platform ahead of time;
- Microcontroller software can be downloaded from <http://www.iar.com/Products/IAR-Embedded-Workbench/TI-MSP430/> ; (get limited-instruction version, not time-limited version)
- National Instrument's MultiSim, version higher than 10.0. (Included in Rizzoni's book, also available from <http://www.studica.com>); should be used for the analog component of the design project.
- Lab equipment and consumables (provided).

COURSE OVERVIEW

Lectures:

Date/Week	Topic	Readings
Week 1	Introduction to microcontrollers	MSP430 User guide
Week 2	MSP430 architecture and instruction set	MSP430 User guide
Week 3	Compiler, builder/linker	MSP430 Instruction set
Week 4	Introduction to C and debugger	C manual
Week 5	Introduction to C	C manual
Week 6	Introduction to C	C manual
	Reading Week	Design process (see above)
Week 7	Introduction to PID	
Week 8	Theory of PID	
Week 9	PID examples	
Week 10-12	Review of student progress	

Labs:

Date	Topic	Readings
Week 1	Introduction to microcontrollers	Lab manual
Week 2	Timer module	Lab manual

Week 3	Serial Communication	Lab manual
Week 4	Interrupts	Lab manual
Week 5	Tracking ADC and Successive Approximation ADC	Lab manual
Week 6	ADC Module and Serial Interface to MATLAB	Lab manual
Week 7	Review of prior lab exercises	
	Reading Week	Design process (see above)
Week 8	Read Thermistor	
Week 9	Output PWM	
Week 10	Serial Comm with MATLAB GUI	
Week 11	Implement PID Control	
Week 12	Project Demonstration	

ASSESSMENT

Component	Weight (%)	Comment
Lab exercises	40	Demo to TA, submit code to ATL
Performance of final project	20	Demo to TA and instructor
Report on final project	40	
Total	100%	

ADDITIONAL DETAILS REGARDING COURSE MANAGEMENT AND ASSESSMENT

1. Class attendance is not mandatory, but encouraged;
2. Attendance at the weekly lab sessions is mandatory and will be recorded;
3. Lab exercises are performed individually;
4. The project is performed in groups of two;
5. Performance is marked individually;
6. Students may not start the project until all lab exercises have been performed and approved by TA.
7. Late submission of final report incurs a penalty of 10% per day;
8. All work is to be submitted through ATL. All work must be prepared with a word processor; scanned or photographed hand-written work is not accepted.

Your final report should be similar to the one from 3BA3, but it will include a description of the software solution that you chose. This should include the following:

1. Describe your solution. Include pseudo code, a flowchart, and a block diagram to aid in your description.
2. Pseudo code
 - i. Write your algorithm for solving the problem
 - ii. Pseudo code should not contain any actual code
 - iii. Sample pseudocode guide: http://users.csc.calpoly.edu/~jdalbey/SWE/pdl_std.html
3. Flowchart
 - i. Draw a flowchart to visually present your algorithm

- ii. Use any reasonable software to complete this
- iii. Sample guide: <https://en.wikipedia.org/wiki/Flowchart>
- 4. Block diagram
 - i. Sketch out your solution (the circuit including the microcontroller), replacing sections with blocks and individually explaining the blocks, if necessary
 - ii. Simple description: http://www.hobbyprojects.com/block_diagrams/block_diagrams.html

ACCREDITATION LEARNING OUTCOMES
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The Learning Outcomes defined in this section are measured for accreditation purposes only, and will not be taken into consideration in determining a student's actual grade in the course.

<u>Outcomes</u>	<u>Indicators</u>
Program a microcontroller using a high-level programming language such as C	1.4
Design a device including a microcontroller and analog circuitry	4.1, 4.3, 4.4
Use of design tools such as MultiSim	5.2
Work in a team of two and three people	6.1, 6.2, 6.3
Present results in an oral presentation	7.1, 7.2
Present results in a written report	7.3

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

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.

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.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at <http://www.mcmaster.ca/academicintegrity>

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.

ACADEMIC ACCOMMODATIONS

Students who require academic accommodation must contact Student accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contact by phone at 905.525.9140 ext. 28652 or e-mail at sas@mcmaster.ca. For further information, consult McMaster University's Policy for [Academic Accommodation of Students with Disabilities](#).

NOTIFICATION OF STUDENT ABSENCE AND SUBMISSION OF REQUEST FOR RELIEF FOR MISSED ACADEMIC WORK

1. The [McMaster Student Absence Form](#) is a self-reporting tool for Undergraduate Students to report absences DUE TO MINOR MEDICAL SITUATIONS that last up to 3 days and provides the ability to request accommodation for any missed academic work. Please note this tool cannot be used during any final examination period.
2. You may submit a maximum of 1 Academic Work Missed request per term. It is YOUR responsibility to follow up with your Instructor immediately (NORMALLY WITHIN TWO WORKING DAYS) regarding the nature of the accommodation. Relief for missed academic work is not guaranteed.
3. If you are absent for reasons other than medical reasons, for more than 3 days, or exceed 1 request per term you MUST visit the Associate Dean's Office (JHE/H301). You may be required to provide supporting documentation.
4. This form must be submitted during the period of absence or the following day, and is only valid for academic work missed during this period of absence.
5. It is the prerogative of the instructor of the course to determine the appropriate relief for missed term work in his/her course.
6. You should expect to have academic commitments Monday through Saturday but not on Sunday or statutory holidays. If you require an accommodation to meet a religious obligation or to celebrate an important religious holiday, you may submit the Academic Accommodation for Religious, Indigenous and Spiritual Observances (RISO) Form to the Associate Dean's Office. You can find all paperwork needed here: <https://www.eng.mcmaster.ca/programs/academic-advising>

NOTICE REGARDING POSSIBLE COURSE MODIFICATION

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

TURNITIN.COM STATEMENT

In this course we will be using a web-based service (Turnitin.com) to reveal plagiarism. Students will be expected to submit their work electronically to Turnitin.com and in hard copy so that it can be checked for academic dishonesty.

Students who do not wish to submit their work to Turnitin.com must still submit a copy to the instructor. No penalty will be assigned to a student who does not submit work to Turnitin.com. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, etc.). To see the Turnitin.com Policy, please go to <http://www.mcmaster.ca/academicintegrity/>.

ON-LINE STATEMENT FOR COURSES REQUIRING ONLINE ACCESS OR WORK

In this course, we will be using Avenue to Learn (ATL) and e-mail. Students should be aware that, when they access the electronic components of this course, 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 this course will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure, please discuss this with the course instructor.

REFERENCE TO RESEARCH ETHICS

The two principles underlying integrity in research in a university setting are these: a researcher must be honest in proposing, seeking support for, conducting, and reporting research; a researcher must respect the rights of others in these activities. Any departure from these principles will diminish the integrity of the research enterprise. This policy applies to all those conducting research at or under the aegis of McMaster University. It is incumbent upon all members of the university community to practice and to promote ethical behaviour. To see the Policy on Research Ethics at McMaster University, please go to <http://www.mcmaster.ca/policy/faculty/Conduct/ResearchEthicsPolicy.pdf>.