ELEC3907 Engineering Project Winter 2022

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Calendar Description

Student teams work on open-ended projects based on previously acquired knowledge. Lectures are devoted to discussing project-related issues and student presentations. A project proposal, a series of project reports, and oral presentations, and a comprehensive final report are required.
Prerequisite(s): ELEC 2607, ELEC 2507, and ((ECOR 1051, ECOR 1052, ECOR 1053 and ECOR 1054) or (ECOR 2606)), and enrolment in the Electrical Engineering program.
Lecture two hours per week, laboratory six hours per week.

Course Aims

This course is intended to expose electrical students to the design environment in electrical engineering through a group project. Working in teams, students will select and proactively pursue an electronic system project for use in a practical application. A series of lectures, including guest speakers, will be included to provide broader understanding of engineering design and related aspects.

Learning Objectives

This course is the first formal project course in the electrical engineering program and as such will act as an introduction to the design process. From a technical perspective the course is expected to draw from material covered in prior and concurrent courses. There will be technical challenges. Complementary to the technical aspects and with equal importance is the challenges associated with working with a team to produce a project on schedule.
Resulting from this course a student should see the technical importance of various topics already covered in the program, have broader appreciation of the design process and aspects such as teamwork, discipline, scheduling and communication. Self reflection is a key aspect of professionalism and this is encouraged and examined within the course.
The expected result will be a deeper appreciation of the importance of technical knowledge, the design cycle and professional skills which will be beneficial for, co-op placements, the fourth year project and final employment.

Course Outcomes

Over the duration of this course students are expected to:

- Work cooperatively and effectively in an organized group, including working remotely
- Create and develop a conceptual design and communicate that design
- Consider relevant design aspects such as safety, performance, cost and product life cycle
- Build the designed item as a team
- Schedule and organize their project work within the time allocated
- Work on individual tasks and create a design report relating to their individual tasks
- Reflect regularly on the work and challenges encountered
- Develop and write a specification for their project product
- Communicate orally on aspects of their project
- Generate a final report, describing the product and its performance

Teaching Modality

Because of the restrictions of numbers in the lab due to COVID-19 this work will be done both in-lab and remotely. So roles in the various teams should be adjusted to accommodate this. Code can be written outside of the lab, but if you want access to good test equipment for hardware then the lab is the place. If the majority of team members are in the Ottawa area and can come to the lab then there may need to be some restriction and so you may have to organize weekly rotations in the lab.

Lectures will be online via Zoom, so all can attend and participate. They will normally be recorded. Sometimes in these lectures presentations will be done by students through Zoom. It is also recommended that video recordings be made throughout the project build so that the final group presentation can be a video. When you get something working record a video of it. You may find that useful later for your final video.

TAs and instructors will be available online during the lab hours. Each student should check in with either a TA or an instructor at least once week.

To facilitate the online lab working Teams will be used. Each Team will have its own area to work within. There will be file space too for exchanging documents. Please note that if you use other group communication platforms, the instructors and TAs will not follow you there. So, if you are working online then you will need to approach the instructors or TAs through the Teams area.

Lecture Schedule (preliminary)

Some of the course deliverables are marked in *italics*.

Full Week	Week starting	Lecture
1	Jan. 10	Introduction (safety, lab books, assessment). Group work Introduction to microcontrollers.
2	Jan 17	Microcontrollers and sensors Morphological charting

Full Week	Week starting	Lecture
3	Jan 24	Projects and work breakdown structures *Reflection 1*
4	Jan 31	Decision making *Project proposal due on the 4th February.*
5	Feb 7	Design reviews I
6	Feb 14	Design reviews II
7	Feb 21	Winter break. No lectures *Reflection 2*
8	Feb 28	Design aspects
9	Mar 7	Guest RF designer Engineering Design Ethics *Individual Reports due 11th March*
10	Mar 14	Guest designer on sustainability and life-cycle design Indigenous Environmental Relations *Reflection 3*
11	Mar 21	One item the group has learned
12	Mar 28	Final design video presentations I *Videos Submitted*
13	Apr 4	Final designs video presentations II
14	Apr 11	Final designs video presentations III *Final Group Report and Reflection 4*

There may be variations in this planned schedule.

Website

This course will make use of BrightSpace. You are expected to check the ELEC3907 area regularly.
There will also be use of Teams. Details of that will be given at the start of the course.

Laboratory Safety

You are expected to follow all safety guidelines as described in the Laboratory Health and Safety Manual http://www.doe.carleton.ca/sites/default/files/health-and-safety.pdf as well as safety directions raised by technical staff, TAs and instructors.
Even when working at home safety protocols should be followed and a self assessment should be made of your personal work environment.
One aspect of the project is product safety and this should be considered in your project design.

Assessment Scheme
There are a number of components to the assessment scheme some are submitted as a group, others individually.

1. Project Proposal 15%
2. Individual Design Report 15%
3. Reflection Journal 15%
4. Oral /Video presentation 10%
5. Final project report 20%
6. Technical assessment of project 15%
7. Individual contribution 10%

Failure to produce a Final Project or a Reflection Journal could result in a F designation.

The personal contribution mark can draw on different aspects of this course, including attendance, group assessment as well as observation by instructors and/or TAs.

Graduate Attributes
An institution must demonstrate that graduates of its programs possess the attributes described below. In addition, the institution must implement and employ processes to demonstrate that program outcomes are being assessed in the context of these attributes, and that the results of such assessments will be applied to the further development of programs. The graduate attributes are:

1. **A knowledge base for engineering**: Demonstrated competence in university level mathematics, natural sciences, engineering fundamentals, and specialized engineering knowledge appropriate to the program.
2. **Problem analysis**: An ability to use appropriate knowledge and skills to identify, formulate, analyze, and solve complex engineering problems in order to reach substantiated conclusions.
3. **Investigation**: An ability to conduct investigations of complex problems by methods that include appropriate experiments, analysis and interpretation of data, and synthesis of information in order to reach valid conclusions.
4. **Design**: An ability to design solutions for complex, open-ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal considerations.
5. **Use of engineering tools**: An ability to create, select, apply, adapt, and extend appropriate techniques, resources, and modern engineering tools to a range of engineering activities, from simple to complex, with an understanding of the associated limitations.
6. **Individual and team work**: An ability to work effectively as a member and leader in teams, preferably in a multi-disciplinary setting.
7. **Communication skills**: An ability to communicate complex engineering concepts within the profession and with society at large. Such ability includes reading, writing,

speaking and listening, and the ability to comprehend and write effective reports and design documentation, and to give and effectively respond to clear instructions.
8. **Professionalism**: An understanding of the roles and responsibilities of the professional engineer in society, especially the primary role of protection of the public and the public interest.
9. **Impact of engineering on society and the environment**: An ability to analyze social and environmental aspects of engineering activities. Such ability includes an understanding of the interactions that engineering has with the economic, social, health, safety, legal, and cultural aspects of society, the uncertainties in the prediction of such interactions; and the concepts of sustainable design and development and environmental stewardship.
10. **Ethics and equity**: An ability to apply professional ethics, accountability, and equity.
11. **Economics and project management**: An ability to appropriately incorporate economics and business practices including project, risk, and change management into the practice of engineering and to understand their limitations.
12. **Life-long learning**: An ability to identify and to address their own educational needs in a changing world in ways sufficient to maintain their competence and to allow them to contribute to the advancement of knowledge.

This course (ELEC 3907) will score attributes **4 *Design*, 6 *Individual and Team Work*, 7 *Communication Skills***. They are scored through the responses provided in assignments, quizzes, pre-lab and lab reports, presentations, final exams. The graduate attribute scores may in some cases be derived from graded material, however the graduate attribute scores are not used in determination of the final grade for the course.

Lab notebooks

Using a lab notebook, or lab-book, is expected in this course, just like in engineering practice. Keeping a record of your work such as; ideas, designs, meetings, test results and notes on problems is a very good idea in professional work. You cannot remember all details and over time these notes can be valuable and time saving. How you record your notes is up to you and it will not be evaluated for grading. However, it will be examined and assessed as part of the *Communication Skills* graduate attribute. It is suggested you use a physical notebook rather than electronic notes.

Times and Locations

The course is in Winter term. For 2022 the times are

- **Lecture:** Monday and Wednesday 1:35 to 2:25pm
- **Laboratory:**
  - Group A01 Tuesday and Thursday 8:35 to 11:25am.
  - Group A02 Monday and Wednesday 10:05am to 12:55pm.
  - Group A03 Tuesday and Thursday 11:35am to 2:25pm.

Please check Carleton Central for any changes to this.

Important Dates

Selected dates and activities from http://calendar.carleton.ca/academicyear/ these are provided for convenience, the link above has the official dates and should be checked to confirm.

10 Jan. 2022	Winter term classes begin
24 Jan. 2022	Last day of registration for fall term and fall/winter courses.
31 Jan. 2022	Last day to withdraw from winter term courses.
21 Feb. 2022	Statutory holiday. University closed.
22-25 Feb. 2022	Winter break. Classes suspended.
16 Mar. 2022	Last day to request formal exam accommodations for April examinations to the Paul Menton Centre for Students with Disabilities.
29 Mar. 2022	Last day for summative tests or examinations, or formative tests or examinations totalling more than 15% of the final grade, in winter term or fall/winter courses before the official examination period (see Examination regulations in the Academic Regulations of the University section of the Undergraduate Calendar/General Regulations of the Graduate Calendar).
12 Apr. 2022	Winter term ends. Last day of fall term classes. Classes follow a Friday schedule. Last day for academic withdrawal from fall term courses. Last day for handing in term work and the last day that can be specified by a course instructor as a due date for term work for fall term courses.
14-28 Apr. 2022	Final examinations in winter term and fall/winter courses may be held. Examinations are normally held all seven days of the week.
15 Apr. 2022	Statutory holiday. University closed.

Academic Accommodation

Details on academic accommodation, for a range of reasons, can be found at https://students.carleton.ca/course-outline/

Office Hours
Because of the large amount of online laboratory time and the chance to interact with instructors and TAs there are no formal scheduled office hours. Individual instructors and TAs can be approached (including via email) for an office appointment, should one be wanted.

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If you email it is recommended you have ELEC3907 somewhere in the subject line.

Books and Other Resources
Because of the nature of this course there is no text that is a required purchase. One useful book though is:

The Arduino Cookbook, Michael Margolis, Brian Jepson and Nicholas Robert Weldin, O'Reilly Media, 3rd Ed., (2020)
Raspberry Pi Cookbook: Software and Hardware Problems and Solutions, Simon Monk, O'Reilly Media, 3rd Ed., (2019)
These are available electronically through the Library.

Please note that the Library has a few Arduino boards available for short loans as well as Raspberry Pis and BeagleBones. Note because of limited campus access you may want to check the availability of the technical items for loan with the Library first.