Faculty of Engineering, Architecture and Science

Department of Electrical and Computer Engineering

Course Outline (W2015)

COE/ELE 800: Design Project

1. Course Description

This course provides the student with a significant experience in self-directed learning. Project topics are provided from which the students select a topic. The topic selection information search, designs and component sourcing are completed as part of the Fall term course COE/ELE 700 Engineering Design. The student individually or in a group, where the topic is a group project, will research the topic, design, implement, and make operational a design of currency in the fields of Electrical and Computer Engineering. Professional guidance is provided by faculty on a weekly basis. The completed project must be demonstrated operational by the last week of the term. A final project report that conforms to professional guidelines is required. The students must demonstrate their working project at an Open House.

Prerequisites:

- ELE 504, ELE 531, ELE 532, MTH 514, ELE 635, ELE 637, ELE 639, MEC 511 and COE 538.
- COE/ELE 700 Engineering Design.

Course Weight: 1.50

2. Important Dates

COE/ELE 800 important dates and deadlines are given below.

<table>
<thead>
<tr>
<th>Week</th>
<th>Dates</th>
<th>Activity</th>
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</thead>
<tbody>
<tr>
<td>Week 2</td>
<td>Jan 12 - Jan 16</td>
<td>Establishment of project management, 3 milestones &amp; deliverables</td>
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<tr>
<td>Week 3</td>
<td>Jan 19 - Jan 23</td>
<td>Lab work / Seminar</td>
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<td>Week 4</td>
<td>Jan 26 - Jan 30</td>
<td>Project management Period 1 deliverable submission and evaluation</td>
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<td>Project Manager 1 submits weekly progress report to FLC</td>
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<td>Week 5</td>
<td>Feb 2 - Feb 6</td>
<td>Lab work / Seminar</td>
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<td>Week 6</td>
<td>Feb 9 - Feb 13</td>
<td>Theory and design sections of report submission</td>
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<td>Week 7</td>
<td>Feb 23 - Feb 27</td>
<td>Project management Period 2 deliverable submission and evaluation</td>
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<td>Project Manager 2 submits weekly progress report to FLC</td>
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<td>Week 8</td>
<td>Mar 2 - Mar 6</td>
<td>Lab work / Seminar</td>
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<tr>
<td>Week 9</td>
<td>Mar 9 - Mar 13</td>
<td>Lab work / Seminar</td>
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<td>Week 10</td>
<td>Mar 16 - Mar 20</td>
<td>Project management Period 3 deliverable submission and evaluation</td>
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<td>Project Manager 3 submits weekly progress report to FLC</td>
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<td>Week 11</td>
<td>Mar 23 - Mar 27</td>
<td>Individual project contribution summary submission prior to oral examination</td>
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<td>Week 12</td>
<td>Mar 30 - Apr 3</td>
<td>Individual Oral examination &amp; Open House Poster submission</td>
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<tr>
<td>Week 13</td>
<td>Apr 6 - Apr 10</td>
<td>Individual Oral examination &amp; Open House Poster submission</td>
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<td></td>
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<td>Group Final EDP report (softcopy) submitted to FLC</td>
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<td></td>
<td>Apr 24 (25)</td>
<td>Open House Exhibition</td>
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<tr>
<td></td>
<td>Apr 30</td>
<td>Final report uploaded to EDP web site</td>
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Each student team is required to submit a weekly progress report at the end of every week. The report template is available at http://www.ee.ryerson.ca/capstone/weekly_report_template.docx.
3. **Faculty Lab Coordinators**

Drs. A. Anpalagan, X. Fernando, V. Geurkov (Course Coordinator), M. Jaseemuddin, S. Karim, L. Kirischian, K. Raahemifar, B. Venkatesh, T. Yang, A. Yazdani, A. Ye, F. Yuan and M. Zeytinoglu.

4. **Course Evaluation**

Course evaluation will be based on students’ laboratory performance and design report.

- Project Management, teamwork and weekly progress: 15%
- Seminars Attendance: 5%
- Milestones Demonstration: 15%
- Oral Examination: 20%
- Final Demonstration: 10%
- Open-House Presentation: 5%
- Final Engineering Design Report: 30%

(a) **Project Management:** The semester is divided into three periods of three weeks each. One student will act as a manager/team leader within a period, thus each student will have a chance to play the role of manager/team leader. The team will select their manager/team leader for each period at the beginning of the semester and provide the names to the FLC. The FLC will mark each student in each period in his/her role as a Manager/Team Leader (Leadership, Conductor of meetings, Organizer/planner/motivator, Conflict resolution) or as a Team Member (Co-operation, Contribution, Conflict resolution). More details on project management are given at the end of this course outline.

(b) **Oral Examination:** Students are required to demonstrate a working prototype and “individually” show a thorough knowledge of their EDP through an oral examination by their assigned Faculty Laboratory Coordinator (FLC). Failure to do so will automatically result in a FAIL grade. **Students who do not keep their FLC advised of their progress on a weekly basis may be refused an oral examination because authorship and contribution to the project is questionable.**

(c) **Open House Presentation & Poster Preparation:** Students are required to participate in an "Open House" exhibition and prepare posters for the exhibition. The Open House is scheduled on April, 2015 and the opening time will be announced and will facilitate visitors and prospective employers. At the Open House, students will demonstrate and discuss their project with visitors from the academic community, their peers, and visitors from industry. Participation in this exhibit may result in a grade revision for enhancements or improvements to the project. Students absent from the Open House will have their grade reflect this.

(d) **Final Engineering Design Report:** The main body of the report is limited to **40 pages**, including text, analysis equations/algorithms diagrams, schematics, tables and references list. Additional material (e.g. source code, datasheets, etc.), not subjected to grading, can be inserted in the APPENDIX. Mark reduction will be applied for report exceeding the 40-page limit. A softcopy of your group final Engineering Design report must be submitted to your FLC. A report submitted without prior satisfactory demonstration of your group project will automatically be given a FAIL grade. The format of the report should conform to professional standards and adequately document the design activities undertaken by the student. If the project includes software, the source code must be included with the report. The softcopy of the final report will be e-mailed back to the student by the Open House together with corrections and suggestions for improvement. The student must make the necessary revisions and upload a soft copy of the Engineering Design report to the EDP web site by April 30th, 2015. If the April deadline is not met for Engineering Design Report submission, the student will not be eligible to graduate.

All written reports will be assessed not only on their technical merit, but also on the communication skills of the author as exhibited through these reports.
5. Engineering Design Project Grading Considerations

The EDP grade awarded to a student who has completed all the requirements, including a successful and timely project demonstration and oral examination, is based on an assessment made by their FLC. Though the wide variation in EDP topic, approach, and challenges encountered by the student does not allow a precise marking scheme to be uniformly applied, the factors described below will be weighted by the FLC to determine the student grade.

a. Laboratory Work

All EDPs require that a concept, an idea, bounded by design specifications in the EDP topic description be researched to provide sufficient knowledge to enable a realistic design be fleshed out. This design is implemented in the laboratory.

The foundations for the EDP grade rest on the design and implementation process. Unless the design is sound and based on solid engineering, the laboratory time will be inefficiently used and the effort frustrating to all involved including the FLC.

Even with a good design, the student will be challenged with implementation and bringing the design to life. The key aspect is the process by which the student tackles the challenges encountered. Is a problem analysed to thoroughly understand its root and a logical decision made as to what options are viable and a strategy devised to confirm the diagnosis and attempt a solution, or is a trial and error quick-fix method employed? How systematic and skilled are the troubleshooting procedures employed; for instance, are results studied carefully or program flow examined, or does the investigator simply "stab in the dark" in the hope of success, with little or no understanding?

Other factors used in evaluating lab performance include time and project management skills. How well did the student meet milestones and GANTT chart schedules, and the consistency with which the project was tackled and ongoing technical documentation?

The variations in project topic and approach, student creativity, ingenuity, novelty and complexity of implementation or success in meeting practical implementation challenges are all factors in grading decisions.

Although a project that has been demonstrated as meeting or exceeding the initial requirements is fundamental for a good grade, the FLC will consider all the aspects in establishing the final grade.

b. EDP Report

The EDP report, an essential course component, is the document on which anyone not intimately involved with the laboratory work assesses the project. In addition, the project value to future investigators is contained within the final report. The report should adequately describe the design activities undertaken in their project.

A good EDP report will improve the primary assessment based on the laboratory work. In general, a good EDP report is required to consolidate the laboratory and project development work performed by the student.

A poor EDP report will certainly demerit even excellent laboratory performance and will be reflected in the overall course grade. Students should make every effort to prepare at least a good EDP report, and for those wishing to achieve an "A" grade or win awards, an excellent Engineering Design report is essential.

The EDP report will normally contain the standard sections: Introduction, Acknowledgements, Certification of Authorship, Index, Abstract, Objectives, Theory, Design, Documentation including Schematics and Parts Lists (together with the parts prices), Measurement / Testing Procedure, Performance Measurements, Analysis of Performance, Time spent on the design of each project component, Conclusions, Appendices, and References.

A few key suggestions are offered:
Particularly in engineering, it is essential that a project be properly designed. A designer must satisfy the examiner, the FLC, that the program or circuit will perform its tasks to specification under all or at least the usual, variations in the operating or manufacturing environment. Such issues as component tolerance, voltage variations, maximum and minimum computer cycle times and data throughputs are examples of variables. In other words, the examiner must be convinced that the project is battle-proof and its operation at the demonstration is not an unusual event.

Another guide used to assess whether the design is competent is to consider the mass production of this prototype. Could one anticipate a reasonable yield and customer satisfaction?

The working prototype performance must be measured to quantify the extent to which it meets the design specifications. The procedure used to measure performance is to be described in sufficient detail that the reader can repeat it. The measured results must be documented in conjunction with appropriate schematics or flow charts. The results should be analysed to ensure that they fit the anticipated performance and if not an explanation is called for.

The abstract must accurately précis the entire report contents in half a page or less. The conclusions should address the project's objectives; to what extent were they met? Where schematics and quotations are taken verbatim from other sources, these sources must be acknowledged to avoid the potentially serious charges of plagiarism.

It is recommended that the hardware be photographed with a digital camera along with a photograph of the student author. These photographs are to be included in the final report.

c. Project Management

The project teams are required to demonstrate their project management skill by putting the theory learnt in COE/ELE 700 into practice in COE/ELE 800. The objectives of the evaluation process in COE/ELE 800 are as follows:

- Each team member receives fair amount of training in project management, and is required to demonstrate the skills of a project manager.
- A project manager is evaluated for his/her capability of planning and achieving a tangible deliverable that can be demonstrated.
- Each student is also required to demonstrate the behavior of a professional team member.

Following management attributes and skills are used in the evaluation process:

- Project Management Attributes
  - Leadership
  - Manager of design process
  - Motivator
  - Organizer/planner

- Skills used to exhibit project management attributes
  - Understanding and managing scope of work/deliverables
  - Design review meeting, recording of minutes and design discussion
  - Timely follow-up
  - Learn to identify strengths/weaknesses
  - Conflict resolution
  - GANTT chart, Critical Path analysis

The semester is divided into three periods of three weeks each:

- Period 1: Week 2, 3 and 4
- Period 2: Week 5, 6 and 7
- Period 3: Week 8, 9 and 10
One student will act as a manager/team leader within a period, thus each student will get a chance to play the role of manager/team leader. The team will select their manager/team leader for each period at the beginning of the semester and provide the names to the FLC.

Each student is marked in each period out of 5 marks in his/her role according to the following metric:

- **Manager/Team Leader**
  - Leadership
  - Conductor of meetings
  - Organizer/planner/motivator
  - Conflict resolution
- **Team Member**
  - Co-operation
  - Contribution
  - Conflict resolution

Project management evaluation:

- FLC will attend one group meeting in each period as an observer
- Each project manager is required to submit a tangible deliverable that can be demonstrated in the lab at the end of his/her term, and a plan to achieve that deliverable.
- Student’s role is evaluated during the weekly progress meeting, through milestone submissions and exhibits.
- The group may be requested to provide necessary information/documents that help FLC in evaluating their project management role.

If there are any changes, announcements will be posted in COE/ELE 800 Course Blackboard. Please check the Blackboard regularly, at least once a week.

6. **Learning Objectives**

At the end of this course, the successful student will be able to:

1. Develop skills of problem solving, systematic diagnose, troubleshooting, critical path analysis, logical decision, engineering trade-off, etc. (2a)
   **Assessment methods:** Weekly progress (milestones demonstration, meetings and reports), project oral examination (problem definition and solving, design choices, analysis and decision, hands-on contribution to project implementation, system diagnosis and troubleshooting), final demonstration, final engineering design report (introduction and objectives, approach and methods, theory and design analysis/synthesis, performance measurement and analysis).
2. Develop creative thinking and capabilities of conducting research/interconnecting various engineering knowledge to formation of realistic designs. (1c, 1d, 12a)
   **Assessment methods:** Weekly progress (including milestones, meetings and reports), seminar attendances and quizzes, project oral exam (problem definition, design choices, analysis and decision, hands-on contribution to project implementation, problem solving), open-house presentation, final engineering design report (theory and design analysis, performance measurement and analysis).
3. Develop ability and technical skills to make decisions in engineering designs. (4g)
   **Assessment methods:** Weekly progress, seminar attendances and quizzes, project oral exam (design choices, analysis and decision, hands-on contribution to project implementation, problem solving), final demonstration, open-house presentation, final engineering design report (introduction and objectives, theory and design analysis, performance measurement and analysis).
4. Develop project management and teamwork skills, which includes leadership, organization, planning, motivation, conflict resolution, design process management, co-operation and contribution. (6a, 6b, 6c, 11b)
   **Assessment methods:** Project Management exam, teamwork, co-operation and weekly progress, seminars attendance, milestones demonstration, project oral examination (design choices, analysis and decision, problem solving), final demonstration, open-house presentation, final engineering design report.
5. Develop reporting and technical writing skill through timely project progress reports and final report. Also, develop presentation skill through milestone demonstrations and public presentation in open-house. (7a, 7b, 7c, 7d, 8a) 

**Assessment methods:** Weekly progress (including milestone demonstration, meetings and reports), project oral examination (problem definition, design choices, analysis and decision, clarity and concise presentation), final demonstration, open-house presentation, final engineering design report (introduction and objectives, approach and methods, theory and design analysis/synthesis, technical writing and general organization).