**Course Outline (F2018)**

**ELE74: Power Electronics**

<table>
<thead>
<tr>
<th>Instructor(s)</th>
<th>MD Shazzat Hossain [Coordinator]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>ENG324</td>
</tr>
<tr>
<td>Phone</td>
<td>TBA</td>
</tr>
<tr>
<td>Email</td>
<td><a href="mailto:mdshazzat.hossain@ryerson.ca">mdshazzat.hossain@ryerson.ca</a></td>
</tr>
<tr>
<td>Office Hours</td>
<td>Tuesdays 11-1 pm</td>
</tr>
</tbody>
</table>

**Calendar Description**

A course on microprocessor-controlled solid state converters. Major topics include: switching devices (SCR, MOSFET, IGBT, GTO, etc.), dc-dc switch mode converters, diode and thyristor rectifiers, current and voltage source inverters, industry applications and microprocessor programming techniques. Typical control schemes for these converters will also be discussed. Important concepts are illustrated with laboratory design projects. Microprocessor based digital controlled power electronic platform will be used in the projects. (Formerly ELE 654).

**Prerequisites**

ELE 504

**Antirequisites**

None

**Corequisites**

None

**Compulsory Text(s):**


**Reference Text(s):**


**Learning Objectives (Indicators):**

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

1. Interconnect the concepts of various engineering knowledge to design and solve the real world engineering problem. (1c)
2. Predict the outcomes of power converter experiment and justify the assumptions given. (3b)
3. Generate solutions for more complex power converter design. (4b)
4. Design and develop software to perform the given tasks in the project. (5a)
5. Demonstrate and explain the result using graphics, waveforms and others. (7c)

**NOTE:** Numbers in parentheses refer to the graduate attributes required by the Canadian Engineering Accreditation Board (CEAB).

**Course Organization**

2.0 hours of lecture per week for 13 weeks
3.0 hours of lab/tutorial per week for 12 weeks

**Teaching Assistants**

TBA
### Course Evaluation

<table>
<thead>
<tr>
<th>Theory</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid Term Examination</td>
<td>25 %</td>
</tr>
<tr>
<td>Final Examination</td>
<td>40 %</td>
</tr>
<tr>
<td>Laboratory</td>
<td></td>
</tr>
<tr>
<td>Digital controlled power electronic platform</td>
<td>5 %</td>
</tr>
<tr>
<td>Digital controlled dc-dc converter and dc motor drive</td>
<td>15 %</td>
</tr>
<tr>
<td>Digital controlled IGBT inverter and induction motor drive</td>
<td>15 %</td>
</tr>
<tr>
<td>TOTAL:</td>
<td>100 %</td>
</tr>
</tbody>
</table>

#### Examinations
Midterm exam in approximately Week 7, two hours, closed-book. Final exam, during exam period, three hours, closed-book. Details will be announced in D2L

#### Other Evaluation Information
Two formal reports on the projects are required. Each report will be assessed not only on academic and laboratorial performance, but also on the communication skills exhibited.

#### Other Information
1) Each lab may contain micro-controller control code and experiment. The sample simulation models and frame of control code (in C language) will be provided in D2L
2) A formal report is required for each lab. The reports should be handed in the first lab class of the next lab.
3) The laboratory component is not only evaluated based on the reports but also the lab performance during the lab class.

### Course Content

<table>
<thead>
<tr>
<th>Week</th>
<th>Hours</th>
<th>Chapters / Section</th>
<th>Topic, description</th>
</tr>
</thead>
</table>
| 1 - 3 | 9     | pp 161 - 199       | DC-DC Switch Mode Converters  
  1.1 Introduction  
  1.2 Non-isolated DC/DC Converters  
  1.3 Isolated DC/DC Converters  
  1.4 Choppers  
  1.5 Control of dc-dc converters |
| 4 - 6 | 9     | pp 79 - 160        | Diode and Thyristor Rectifiers  
  2.1 Introduction  
  2.2 Single and three phase diode rectifiers  
  2.3 Total harmonic distortions and power factor  
  2.4 Single and three phase thyristor (SCR) rectifiers  
  2.5 Control of thyristor rectifiers |
| 8 - 10 | 9 | pp 200 - 248 & 399 - 434 | Inverters (dc-ac converters)  
  3.1 Introduction  
  3.2 Single-phase Inverters  
  3.3 Three-phase IGBT Inverters  
  3.4 PWM techniques  
  3.5 Current source Inverters  
  3.6 Induction Motor Speed Control |
4.1 Introduction
4.2 Uninterruptible power supplies (UPS)
4.3 Power supplies
4.4 AC/DC Motor drives
4.5 Active power filters
4.6 Static var compensators
4.7 Electronic ballasts

5.1 Introduction
5.2 Snubber circuit design
5.3 Gate drive circuits
5.4 Heatsink design

Laboratory/Tutorials/Activity Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Lab</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 - 3</td>
<td>Tutorial</td>
<td>Digital controlled power electronic platform</td>
</tr>
<tr>
<td>4 - 7</td>
<td>Project 1</td>
<td>Digital controlled dc-dc converter and dc motor drive</td>
</tr>
<tr>
<td>8 - 12</td>
<td>Project 2</td>
<td>Digital controlled IGBT inverter and induction motor drive</td>
</tr>
</tbody>
</table>

Policies & Important Information:

1. Students are required to obtain and maintain a Ryerson e-mail account for timely communications between the instructor and the students;
2. Any changes in the course outline, test dates, marking or evaluation will be discussed in class prior to being implemented;
3. Assignments, projects, reports and other deadline-bound course assessment components handed in past the due date will receive a mark of ZERO, unless otherwise stated. Marking information will be made available at the time when such course assessment components are announced.
4. If you have taken the course previously and are currently looking to get a laboratory exemption, then you must fill out this form: http://www.ee.ryerson.ca/guides/ECE-LabExemptionForm.pdf
5. Refer to our Departmental FAQ page for information on common questions and issues at the following link: https://www.ee.ryerson.ca/guides/Student.Academic.FAQ.html

Missed Classes and/or Evaluations

When possible, students are required to inform their instructors of any situation which arises during the semester which may have an adverse effect upon their academic performance, and must request any consideration and accommodation according to the relevant policies as far in advance as possible. Failure to do so may jeopardize any academic appeals.

1. **Health certificates** - If a student misses the deadline for submitting an assignment, or the date of an exam or other evaluation component for health reasons, they should notify their instructor as soon as possible, and submit a Ryerson Student Health Certificate AND an Academic Consideration Request form within 3 working days of the missed date. Both documents are available at https://www.ryerson.ca/senate/forms/medical.pdf. If you are a full-time or part-time degree student, then you submit your forms to your own program department or school;
2. **Religious, Aboriginal and Spiritual observance** - If a student needs accommodation because of religious, Aboriginal or spiritual observance, they must submit a Request for Accommodation of Student Religious, Aboriginal and Spiritual Observance AND an Academic Consideration Request form within the first 2 weeks of the class or, for a final examination, within 2 weeks of the posting of the examination schedule. If the requested absence occurs within the first 2 weeks of classes, or the dates are not known well in advance as they are linked to other conditions, these forms should be submitted with as much lead time as possible in advance of the absence. Both documents are available at www.ryerson.ca/senate/forms/relobservforminstr.pdf. If you are a full-time or part-time degree student, then you submit the forms to your own program department or school;
3. **Academic Accommodation Support** - Before the first graded work is due, students registered with the Academic Accommodation Support office (AAS - www.ryerson.ca/studentlearnsupport/academic-accommodation-support) should provide their instructors with an Academic Accommodation letter that describes their academic accommodation plan.
Ryerson’s Policy 60 (the Academic Integrity policy) applies to all students at the University. Forms of academic misconduct include plagiarism, cheating, supplying false information to the University, and other acts. The most common form of academic misconduct is plagiarism - a serious academic offence, with potentially severe penalties and other consequences. It is expected, therefore, that all examinations and work submitted for evaluation and course credit will be the product of each student’s individual effort (or an authorized group of students). Submitting the same work for credit to more than one course, without instructor approval, can also be considered a form of plagiarism.

Suspensions of academic misconduct may be referred to the Academic Integrity Office (AIO). Students who are found to have committed academic misconduct will have a Disciplinary Notation (DN) placed on their academic record (not on their transcript) and will normally be assigned one or more of the following penalties:

1. A grade reduction for the work, ranging up to an including a zero on the work (minimum penalty for graduate work is a zero on the work);
2. A grade reduction in the course greater than a zero on the work. (Note that this penalty can only be applied to course components worth 10% or less, and any additional penalty cannot exceed 10% of the final course grade. Students must be given prior notice that such a penalty will be assigned (e.g. in the course outline or on the assignment handout);
3. An F in the course;
4. More serious penalties up to and including expulsion from the University.

The unauthorized use of intellectual property of others, including your professor, for distribution, sale, or profit is expressly prohibited, in accordance with Policy 60 (Sections 2.8 and 2.10). Intellectual property includes, but is not limited to:

1. Slides
2. Lecture notes
3. Presentation materials used in and outside of class
4. Lab manuals
5. Course packs
6. Exams

For more detailed information on these issues, please refer to the Academic Integrity policy (https://www.ryerson.ca/senate/policies/pol60.pdf) and to the Academic Integrity Office website (https://www.ryerson.ca/academicintegrity/).

Important Resources Available at Ryerson

1. The Library (https://library.ryerson.ca/) provides research workshops and individual assistance. Inquire at the Reference Desk on the second floor of the library, or go to library.ryerson.ca/guides/workshops.
2. Student Learning Support (https://www.ryerson.ca/studentlearningsupport) offers group-based and individual help with writing, math, study skills and transition support, and other issues.

Approved by: _______________________________                Date ________________________________
Course Instructor

Approved by: _______________________________                Date ________________________________
Associate Chair or Program Director