RYERSON UNIVERSITY

Faculty of Engineering, Architecture and Science
Department of Electrical and Computer Engineering

EE8407: Power Converter Systems

Prerequisite	ELE654 Power Electronics or equivalent
Course Web Page	http://www.ee.ryerson.ca/~courses/ee8407
Reference Text	Bin Wu, "High-Power Converters and AC Drives," Wiley - IEEE Press, 2006
Calendar Description	A course on the analysis, simulation and design of power converter systems. Main topics include: high-power multi-pulse rectifiers, multilevel voltage and current source converters, pulse width modulation, harmonic reduction techniques, modeling and simulation techniques, and industrial applications. Important concepts are illustrated with design projects using Matlab/Simulink.
Learning Objectives	At the end of this course, the successful student will have a solid knowledge on the converter topologies, operating principles, modulation techniques and control of a variety of high-power converters with a voltage rating of a few kilovolts and power rating in the megawatt range. The students will be able to analyze and design these converters using commercial simulation tools such as Matlab/Simulink. Method used to asses the Learning Objective: project reports and final exam.
Course Organization	2 hours of lecture per week for 13 weeks 1 hour of lab per week for 12 weeks

Course Evaluation

Design projects (5 projects)	65%
Final exam	35%
Total	100%

Examinations Final exam during the exam period, two hours, closed book, in computer laboratories (covers all the course and project materials).

Project Students are required to analyze, model, simulate and design various types of high-power converters, including multi-pulse rectifiers, multilevel voltage source converters and PWM current source converters. All the projects are design-oriented. The students are required to make an extensive use of the knowledge acquired from the course, and submit a report for each of the projects, which must be prepared in a single-column double-space format, and must contain the followings:

- Title page - Title of the project, authors' name, and course name.
- Table of contents - list of sections, and subsections of the project report.
- Abstract - Abstract of the project report.

- Main body of the project report - including introduction, theoretical analysis and design, simulation results, and conclusions.
- References - list of books, papers and other publications used in the project report. References must be listed using IEEE reference styles.
- Appendices - Top-level Simulink block diagrams used in the project.

Course Content

Week	Detailed Description	Hours
1	Introduction (Chapter 1)	2
1,2	High-Power Semiconductor Devices (Chapter 2)	2
3	Multipulse Diode Rectifiers (Chapter 3)	2
3,4	Multipulse SCR Rectifiers (Chapter 4)	2
4,5	Two-level Voltage Source Inverter (Chapter 6)	3
6,7	Multilevel Cascaded H-Bridge Converters (Chapter 7)	4
8,9	Multilevel Diode-Clamped Inverter (Chapter 8)	4
10	Other Multilevel Voltage Source Converters (Chapter 9)	2
11,12	Current Source Inverters (Chapter 10)	3
13	Current Source Rectifiers (Chapter 11)	2

Laboratory/Projects - Room ENG408 and ENG412

Projects/ Laboratories	Detailed Description	Marks	Week
1	Series-type 12-pulse Diode Rectifier	12%	2-3
2	Space Vector Modulation Technique	17%	4-6
3	Multilevel Cascaded H-Bridge Inverters	12%	7-8
4	Multilevel diode Clamped Inverters	12%	9-10
5	PWM Techniques for Current Source Converters	12%	11-12
Total		65%	

Note: Schedule of lectures and labs is tentative. There may be some changes in the schedule that will be announced in the class and posted on course website.

Important Notes

1. All of the required course-specific written reports will be assessed not only on their technical/academic merit, but also on the communication skills exhibited through these reports.
2. All assignment and lab/tutorial reports must have the standard cover page which can be completed and printed from the Department website at www.ee.ryerson.ca. The cover page must be signed by the student(s) prior to submission of the work. Submissions without the cover pages **will not** be accepted.
3. Should a student miss a mid-term test or equivalent (e.g. studio or presentation), with appropriate documentation, a make-up will be scheduled as soon as possible in the same semester. Make-ups should cover the same material as the original assessment but need not be of an identical format. Only if it is not possible to schedule such a make-up may the weight of the missed work be placed on the final exam, or

another single assessment. This may not cause that exam or assessment to be worth more than 70% of the student's final grade. If a student misses a scheduled make-up test or exam, the grade may be distributed over other course assessments even if that makes the grade on the final exam worth more than 70% of the final grade in the course.

4. Students who miss a final exam for a verifiable reason and who cannot be given a make-up exam prior to the submission of final course grades, must be given a grade of INC (as outlined in the *Grading Promotion and Academic Standing Policy)* and a make-up exam (normally within 2 weeks of the beginning of the next semester) that carries the same weight and measures the same knowledge, must be scheduled.
5. Medical or Compassionate documents for the missing of an exam must be submitted within 3 working days of the exam. Students are responsible for notifying the instructor that they will be missing an exam as soon as possible.
6. Requests for accommodation of specific religious or spiritual observance must be presented to the instructor no later than two weeks prior to the conflict in question (in the case of final examinations within two weeks of the release of the examination schedule). In extenuating circumstances this deadline may be extended. If the dates are not known well in advance because they are linked to other conditions, requests should be submitted as soon as possible in advance of the required observance. Given that timely requests will prevent difficulties with arranging constructive accommodations, students are strongly encouraged to notify the instructor of an observance accommodation issue within the first two weeks of classes.
7. The results of the first test or mid-term exam will be returned to students before the deadline to drop an undergraduate course in good Academic Standing.
8. Students are required to adhere to all relevant University policies including:
   Undergraduate Grading, Promotion and Academic Standing,
   http://www.ryerson.ca/senate/policies/pol46.pdf
   Student Code of Academic Conduct, http://www.ryerson.ca/senate/policies/pol60.pdf
   Student Code of Non-Academic Conduct, http://www.ryerson.ca/senate/policies/pol61.pdf
   Undergraduate Academic Consideration and Appeals, http://www.ryerson.ca/senate/policies/pol134.pdf
   Examination Policy, http://www.ryerson.ca/senate/policies/pol135.pdf
   Accom. of Student Relig., Abor. and Spir. Observance, http://www.ryerson.ca/senate/policies/pol150.pdf
   Est. of Stud. Email Accts for Official Univ. Commun., http://www.ryerson.ca/senate/policies/pol157.pdf
9. Students are required to obtain and maintain a Ryerson Matrix e-mail account for timely communications between the instructor and the students.
10. Any changes in the course outline, test dates, marking or evaluation will be discussed in class prior to being implemented.
11. In-class use of cellular telephones is not permitted. Please turn off your cell phone prior to class. Quiet use of laptops, text-messengers and similar non-audible devices are permitted only in the rear rows of the class. This restriction allows use of such devices by their users while limiting audible and visual distractions to other students. This policy may change without notice.
12. Labs, projects handed in past the due date and time will not be accepted for marking and will receive a mark of ZERO. In some genuine cases late submission will be allowed with a penalty of 5% per day.
13. Students found to have plagiarized *any* portion of their labs and final project will receive a grade of zero on the *complete* project. This automatically will lead to a failing grade.

Name of Instructor		Signature of Instructor		Date	
Name of Graduate Program Director		Signature of Graduate Program Director		Date	