



Department of Electrical and Computer Engineering
Faculty of Engineering and Applied Science

Course Outline

ENGI 9834

Fall 2024-2025

ENGI 9834: Advanced Power Electronics

Instructor	Mohsin Jamil	Teaching Assistant:	Friderick Nana Oppong
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Office Hours	Mondays, 11:00 AM – 1:00 PM		

Communication mjamil@online.mun.ca (Course Email Using D2L)

Website <http://online.mun.ca> (D2L)

CALENDAR ENTRY:

ENGI 9834 Advanced Power Electronics is an overview of power semiconductor switches, an introduction to energy conversion and control techniques and examination of controlled rectifiers; phase-controlled converters; switch-mode dc/dc converters; variable frequency dc/ac inverters; ac/ac converters; gate and base drive circuits; design of driver and snubber circuits; thermal models and heat sink design.

PREREQUISITES: ECE 5300: ELECTRONICS CIRCUITS II
ECE 6810 POWER ELECTRONICS OR EQUIVALENT

SCHEDULE:

LECTURE: Tuesday and Thursday, 9:00 – 10:30 am Room: EN4035
TUTORIAL: Thursdays, 12:00– 13:00 PM, Room: EN4008
LABORATORY: Mondays, 2:00 – 5:00 pm, Room CSF-3103

CREDIT VALUE: 3 credit hours

COURSE TYPE: Elective

PROJECT TYPE: HANDS ON (LAB Based Prototype)

LAB SAFETY:

Students are expected to demonstrate awareness of, and personal accountability for, safe laboratory conduct. Appropriate personal protective equipment (PPE) must be worn (e.g., steel-toed shoes, safety glasses, etc.) and safe work practices must be followed as indicated for individual laboratories, materials and equipment. Students will immediately report any concerns regarding safety to the teaching assistant, staff technologist, and professor.

ACCREDITATION UNITS:

Contact hours/week: 3/2/1

CONTENT CATEGORIES: (expressed as %, no category can be $0 < c < 25$)

Math	Natural science	Complementary Studies	Engineering Science	Engineering Design
			75%	25%

RESOURCES:

TEXT BOOK

- "Power Electronics: Circuits, Devices and Applications" by Muhammad H. Rashid, Pearson, 4th Edition, 2014.

REFERENCES

- Power Electronics Handbook, Third Edition, Muhammad H. Rashid, Elsevier, 2011.
- Principles of Power Electronics, John G. Kassakian, Martin F. Schlecht and George C. Verghese, Pearson, 1991.
- Power Electronics: Converters, Applications and Design, Ned Mohan, Tore M. Undeland and William P. Robbins, Jon Wiley and Sons, 2nd Edition, 1995.
- High Power Converters and AC Drives, Bin Wu, IEEE Press, 2006.
- IEEE Explore, <http://ieeexplore.ieee.org/Xplore/home.jsp>

MAJOR TOPICS:

- Power Electronic Devices (e.g. Diodes, Thyristors, Thyristor, Triac, and IGBT)
- AC-DC Converters (e.g. Rectifiers)
- DC-DC Converters (e.g. Buck/Boost)
- DC-AC Converters (e.g. Inverters)
- AC-AC Converters (e.g. Matrix Converters)
- Power Quality and Modulation Techniques
- Digital Control of Power Electronic Converters
- Grid Interface of Renewable Energy Sources
- Practical Issues in Power Electronic Converters (e.g. EMI, Thermal Management etc.)
- Case Studies

ASSESSMENTS:

Quizzes (2)	15%
Quiz 1	
Quiz 2	
Assignments (2)	15%
Assignment 1	
Assignment 2	
Midterm Exam	20%
Project Presentation	15%
Final Project Report	35%

Approximate Due Dates

Week 04 (Thursday, September 26, 2024)
Week 10 (Tuesday, November 08, 2024)
Week 06 (Friday, October 11, 2024)
Week 10 (Tuesday, November 05, 2024)
Week 11 (Tuesday, November 12, 2024)
November 18 November 2024
TBA (05-13 December 2024)

LEARNING OUTCOMES:

Course Level Graduate Attribute Focus: KB-D, PA-A, Des-D

Upon successful completion of this course, the student will be able to:

1	Get familiarized with various types of power electronics devices such as Diode and Thyristors	KB.8-D PA.3-A	Quizzes, assignments, midterm, final exam
2	Learn the design and operation of single-phase and three-phase diode rectifiers.	KB.8-D, PA.3-A	Quizzes, assignments, midterm, final exam
3	Understand basic principles and design of dc-dc power converters	KB.8-D, PA.3-A	Quizzes, assignments, midterm, final exam
4	Learn the design and operation of single-phase and three-phase dc-ac converters (inverters).	KB.8-D, PA.3-A	Quizzes, assignments, midterm, final exam
5	Understand basic principles and design of ac-ac power converters	KB.8-D, PA.3-A	Quizzes, assignments, final exam
6	Understand power quality and harmonic distortion.	KB.8-D, PA.3-A	Quizzes, assignments, final exam
7	Understand the Sinusoidal Pulse Width Modulation (SPWM) technique.	KB.8-D, PA.3-A	Assignments, final exam
8	Understand and explain different control schemes for power electronic converters	KB.8-D, PA.3-A	Quizzes, assignments, midterm, final exam
9	Implement power electronic converters and controllers using MATLAB	Tools.1-D	Assignments
10	Analyse Thermal Modelling and Design of Heat Sink	KB.8-D	Assignments

Each Graduate Attribute for each learning outcome is rated at a Content Instructional Level of I=Introductory, D=Developed, or A=Applied).



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See <http://www.mun.ca/engineering/undergrad/graduateattributes.pdf> for more information on the 12 Graduate Attributes you are expected to be proficient in upon graduation.

ACADEMIC INTEGRITY AND PROFESSIONAL CONDUCT:

Students are expected to conduct themselves in all aspects of the course at the highest level of academic integrity. Any student found to commit academic misconduct will be dealt with according to the Faculty and University practices. More information is available at <http://www.mun.ca/engineering/undergrad/academicintegrity.php>

Students are encouraged to consult the Faculty of Engineering and Applied Science Student Code of Conduct at <http://www.mun.ca/engineering/undergrad/academicintegrity.php> and Memorial University's Code of Student Conduct at <http://www.mun.ca/student/conduct/>.

INCLUSION AND EQUITY:

Students who require accommodations are encouraged to contact the Glenn Roy Blundon Centre, <http://www.mun.ca/blundon/about/index.php>. The mission of the Blundon Centre is to provide and coordinate programs and services that enable students with disabilities to maximize their educational potential and to increase awareness of inclusive values among all members of the university community.

The university experience is enriched by the diversity of viewpoints, values, and backgrounds that each class participant possesses. In order for this course to encourage as much insightful and comprehensive discussion among class participants as possible, there is an expectation that dialogue will be collegial and respectful across disciplinary, cultural, and personal boundaries.

STUDENT ASSISTANCE:

Student Affairs and Services offers help and support in a variety of areas, both academic and personal. More information can be found at www.mun.ca/student