

WESTERN UNIVERSITY  
FACULTY OF ENGINEERING

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

**ECE 9403A – HIGH FREQUENCY POWER ELECTRONIC CONVERTERS**

**COURSE OUTLINE - 2023 – 2024**  
**(M.E.Sc & Ph.D ONLY)**

**DESCRIPTION**

The main task of power electronics is to use power semiconductor devices in converter structures (topologies) to process and control the flow of electric energy by supplying voltages and currents in a form that is optimally for user loads. Such user loads include computer and telecommunications equipment, medical equipment, electric vehicles, motor drives, utility applications, welding, induction heating, etc. The object of the course is to familiarize the student with various advanced power electronic converter topologies and their practical application.

**ENROLLMENT RESTRICTIONS**

Enrollment in this course is restricted to graduate students in Electrical Engineering, as well as any student that has obtained special permission to enroll in this course from the course instructor as well as the Graduate Chair (or equivalent) from the student's home program.

**PREREQUISITES**

An undergraduate degree in electrical engineering **AND** an undergraduate course in power electronics **OR** permission from the instructor.

**COURSE FORMAT**

In person.

**TOPICS:**

The following topics will be covered in the course:

1. Dc-dc switch-mode converters
2. Switch-mode dc power supplies (with transformer isolation)
3. Resonant dc-dc converters
4. Soft-switching PWM converters
5. Input power factor correction
6. Single-stage power converters
7. Miscellaneous topics (i.e. applications, components, control)

The learning activities associated with these topics will include lectures, reading material, assignments, and an examination.

### SPECIFIC LEARNING OUTCOMES

Degree Level Expectation	Weight	Assessment Tools	Outcomes
<b>Depth and breadth of knowledge</b>	50%	<ul style="list-style-type: none"> <li>• Assignments</li> <li>• Project</li> <li>• Examinations</li> </ul>	<ul style="list-style-type: none"> <li>• Understanding of advanced concepts and theories</li> <li>• Awareness of important current problems in the field of study</li> <li>• Understanding of computational and/or empirical methodologies to solve related problems</li> </ul>
<b>Application of knowledge</b>	50%	<ul style="list-style-type: none"> <li>• Assignments</li> <li>• Project</li> <li>• Examinations</li> </ul>	<ul style="list-style-type: none"> <li>• Ability to apply knowledge in a rational way to analyze a particular problem</li> <li>• Ability to use coherent approach to design a particular engineering system using existing design tools</li> </ul>

### ASSESSMENTS

The final course grade will be determined from a student's performance on assignments, a project, and a final examination. The weighting of each of these components is as follows:

Assignments	25%
Project	25%
Final Examination (3 hours)	50%

To obtain a passing grade in the course, a student must obtain a minimum of 50% in all three components of the course. A mark < 50% in any of the components will result in a final course grade of 48% or less. Details about the mechanics of the final examination (e.g. what material will be allowed) will be given to students at least one week in advance of the final examination date.

A project will be assigned to each student and will consist of a report that will be done at the end of the semester. A project topic will be assigned to each student sometime during the semester. A student can work on a project of his or her own choosing provided it is approved by the instructor.

### REQUIRED TEXTBOOK

There will be no assigned textbook for the course. Course material in the form of conference papers, lecture notes or photocopies will be provided in class and/or posted on the OWL site of the course.

### OPTIONAL COURSE READINGS

Optional reading material on dedicated topics may be posted on the course OWL site.

## **CHEATING, PLAGIARISM/ACADEMIC OFFENCES**

Academic integrity is an essential component of learning activities. Students must have a clear understanding of the course activities in which they are expected to work alone (and what working alone implies) and the activities in which they can collaborate or seek help; see information above and ask instructor for clarification if needed. Any unauthorized forms of help-seeking or collaboration will be considered an academic offense. University policy states that cheating is an academic offence. If you are caught cheating, there will be no second warning. Students must write their essays and assignments in their own words. Whenever students take an idea or a passage of text from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence. Academic offences are taken seriously and attended by academic penalties which may include expulsion from the program. Students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence at the following website:

[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_grad.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_grad.pdf)

## **CONDUCT**

Students are expected to follow proper etiquette to maintain an appropriate and respectful academic environment. Any student who, in the opinion of the instructor, is not appropriately participating in course activities and/or is not following the rules and responsibilities associated with the course activities, will be reported to the Associate Dean (Graduate) (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Associate Dean (Graduate), the student could be debarred from completing the assessment activities in the course as appropriate.

## **HEALTH/WELLNESS SERVICES**

As part of a successful graduate student experience at Western, we encourage students to make their health and wellness a priority. Western provides several health and wellness related services to help you achieve optimum health and engage in healthy living while pursuing your graduate degree. Information regarding health- and wellness-related services available to students may be found at <http://www.health.uwo.ca/>.

Students seeking help regarding mental health concerns are advised to speak to someone they feel comfortable confiding in, such as their faculty supervisor, their program director (graduate chair), or other relevant administrators in their unit. Faculty of Engineering has a Student Wellness Counsellor. To schedule an appointment with the counsellor, contact Kristen Edwards ([khunt29@uwo.ca](mailto:khunt29@uwo.ca)) via confidential email and you will be contacted by our intake office within 48 hours to schedule an appointment.

Students who are in emotional/mental distress should refer to Mental Health@Western: <http://www.uwo.ca/uwocom/mentalhealth/> for a complete list of options about how to obtain help.

**SICKNESS**

Students should immediately consult with the Instructor (for a particular course) or Associate Chair (Graduate) (for a range of courses) if they have problems that could affect their performance. The student should seek advice from the Instructor or Associate Chair (Graduate) regarding how best to deal with the problem. Failure to notify the Instructor or the Associate Chair (Graduate) immediately (or as soon as possible thereafter) will have a negative effect on any appeal. Obtaining appropriate documentation (e.g., a note from the doctor) is valuable when asking for accommodation due to illness.

Students who are not able to meet certain academic responsibilities due to medical, compassionate or other legitimate reason(s), could request for academic consideration. The Graduate Academic Accommodation Policy and Procedure details are available at:

<https://www.eng.uwo.ca/graduate/current-students/academic-support-and-accommodations/index.html>

**ACCESSIBLE EDUCATION WESTERN (AEW)**

Western is committed to achieving barrier-free accessibility for all its members, including graduate students. As part of this commitment, Western provides a variety of services devoted to promoting, advocating, and accommodating persons with disabilities in their respective graduate program. Graduate students with disabilities (for example, chronic illnesses, mental health conditions, mobility impairments) are strongly encouraged to register with Accessible Education Western (AEW): [http://academicsupport.uwo.ca/accessible\\_education/index.html](http://academicsupport.uwo.ca/accessible_education/index.html)

AEW is a confidential service designed to support graduate and undergraduate students through their academic program. With the appropriate documentation, the student will work with both AEW and their graduate programs (normally their Graduate Chair and/or Course instructor) to ensure that appropriate academic accommodations to program requirements are arranged. These accommodations include individual counselling, alternative formatted literature, accessible campus transportation, learning strategy instruction, writing exams and assistive technology instruction.

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