

**Carleton University**  
**Department of Electronics Engineering**  
**ELEC 3908 – Physical Electronics – Winter 2023**  
**Course Outline**

**Introduction:**

This course examines the structure, fabrication, physical operation and modeling of semiconductor diodes, bipolar transistors and MOSFETs.

**Instructor:**

**Professor Ravi Prakash**

Office: 5160 Mackenzie

Email: [ravi.prakash@carleton.ca](mailto:ravi.prakash@carleton.ca)

Web page: <https://carleton.ca/doe/people/ravi-prakash/>

Course Site: Course webpage on Brightspace

**Teaching Assistants:**

1. Jake Staples

Email: [jakestaples@cmail.carleton.ca](mailto:jakestaples@cmail.carleton.ca)

2. Shiva Ashoori

Email: [ShivaAshoori@cmail.carleton.ca](mailto:ShivaAshoori@cmail.carleton.ca)

**Course Pack:**

A course pack containing PDF of summary course notes is made available on the Brightspace course homepage. Weekly lecture notes and sample problems will be posted every Friday during the term.

**Tutorial Sessions:**

Tutorial sessions will be held by the teaching assistants for a duration of three hours per week. Please refer to the course schedule available on Brightspace to learn more about the timing of tutorial sessions. Quizzes and Mid-term exams will also be held during tutorial sessions as identified in the same document.

**Lab Sessions and Lab Reports:**

Lab sessions are designed to be completed within 2.5-hour session and the instructions will be posted on the website ahead of time.

Groups of two-three students will be assigned to work together to collect data. Analysis of the data and associated calculations are to be done individually.

All lab reports, which must include all the required material compiled into a single PDF, will be due on Brightspace by midnight on the seventh day following the lab, unless otherwise indicated. You must include the name of your lab partner(s) on the cover page of your report. Attending the lab period and the proper collection of required data accounts for approximately half of the lab grade and the analysis of YOUR data for the other half.

**There is a 10% per day penalty for late reports - submission of all lab reports is MANDATORY for successful completion of the course.**

### **Quizzes, Mid-term and Final Exam:**

Two quizzes, designed to be 45-minute long, will be held during the term. They will be held in select tutorial sessions; please refer to course schedule.

A mid-term exam will be held during one of the tutorial sessions following the reading week. The mid-term exam will be 75-minute long.

The final exam will be three-hour long.

**Note:** All exams will be **closed-book** and will be **held in-person**. If you miss a quiz or mid-term with a valid reason, you can request to take a make-up test. As per University policy, the quiz or mid-term grade portion is not transferred to the final exam.

### **Calculator Policy:**

Programmable calculators will not be allowed in the quizzes or final exam. A “programmable calculator” is defined as a calculator that can store program steps or text at any level of sophistication and the rule applies irrespective of whether or not there appears to be anything stored. If you have any doubts about the eligibility of your calculator, please see me well before the exam. You can't use your cell phone.

### **Course Grade:**

The final grade will be determined using the following weighting.

Quizzes (2@10% each)	20%
Labs (3@5% each)	15%
Mid-term Exam	15%
Final Exam	50%
Total	100%

**Note:** Students must pass the final exam in order to pass the course.

### **Quiz, Exam and Lab grade listings:**

All in-term assessment grades will be posted on the course Brightspace website. Students will be notified through Brightspace announcements about marks posting. Please check your marks online and report any discrepancies immediately. Errors must be reported to the appropriate marking TA during TA office hour. Please monitor the course website any changes to marking and assessments.

### **Final Exam Availability:**

In keeping with university policy, students have the right to have questions regarding their grades addressed and to view all material, including material that has not been returned such as final examinations. In some cases, the original submitted work will remain in the possession of the University and the viewing of this work may be supervised. In cases where a student has concerns

regarding the determination of their final grade, the student will be provided with a list of their grades on all components of the course and a description of how their final grade was calculated.

### **Graduate Attributes:**

An institution must demonstrate that graduates of its programs possess the attributes described below. In addition, the institution must implement and employ processes to demonstrate that program outcomes are being assessed in the context of these attributes, and that the results of such assessments will be applied to the further development of programs. The graduate attributes are:

1. **A knowledge base for engineering:** Demonstrated competence in university level mathematics, natural sciences, engineering fundamentals, and specialized engineering knowledge appropriate to the program.
2. **Problem analysis:** An ability to use appropriate knowledge and skills to identify, formulate, analyze, and solve complex engineering problems in order to reach substantiated conclusions.
3. **Investigation:** An ability to conduct investigations of complex problems by methods that include appropriate experiments, analysis and interpretation of data, and synthesis of information in order to reach valid conclusions.
4. **Design:** An ability to design solutions for complex, open-ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal considerations.
5. **Use of engineering tools:** An ability to create, select, apply, adapt, and extend appropriate techniques, resources, and modern engineering tools to a range of engineering activities, from simple to complex, with an understanding of the associated limitations.
6. **Individual and team work:** An ability to work effectively as a member and leader in teams, preferably in a multi-disciplinary setting.
7. **Communication skills:** An ability to communicate complex engineering concepts within the profession and with society at large. Such ability includes reading, writing, speaking and listening, and the ability to comprehend and write effective reports and design documentation, and to give and effectively respond to clear instructions.
8. **Professionalism:** An understanding of the roles and responsibilities of the professional engineer in society, especially the primary role of protection of the public and the public interest.
9. **Impact of engineering on society and the environment:** An ability to analyze social and environmental aspects of engineering activities. Such ability includes an understanding of the interactions that engineering has with the economic, social, health, safety, legal, and cultural aspects of society, the uncertainties in the prediction of such interactions; and the concepts of sustainable design and development and environmental stewardship.
10. **Ethics and equity:** An ability to apply professional ethics, accountability, and equity.
11. **Economics and project management:** An ability to appropriately incorporate economics and business practices including project, risk, and change management into the practice of engineering and to understand their limitations.

12. **Life-long learning:** An ability to identify and to address their own educational needs in a changing world in ways sufficient to maintain their competence and to allow them to contribute to the advancement of knowledge.

In ELEC 3908, student work is assessed to score graduate attribute 1 (knowledge base; KB) for engineering. The graduate attribute scores may be derived through one or more quiz and exam grades however the graduate attribute scores are not used in determination of the final grade for the course.

**Requesting Temporary Academic Accommodation:**

Since the beginning of the COVID-19 pandemic, Carleton has temporarily suspended the need for doctor's notes or medical certificates for academic accommodation requests related to COVID-19. We are extending this process for the Winter 2023 term since it continues to be more difficult than usual for students to see a doctor and obtain documentation.

In place of a doctor's note or medical certificate, students will be advised to complete the self-declaration form available on the Registrar's website (<https://carleton.ca/registrar/wp-content/uploads/self-declaration.pdf>) to request academic accommodation for missed course work including exams and assignments. Self-declaration forms must be submitted prior to a submission or an exam deadline for due consideration.

**Academic Accommodations for Students with Disabilities:** The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or [pmc@carleton.ca](mailto:pmc@carleton.ca) for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website for the deadline to request accommodations for the formally-scheduled exam (if applicable) at <http://www.carleton.ca/pmc/new-and-current-students/dates-and-deadlines/>. You can visit the Equity Services website to view the policies and to obtain more detailed information on academic accommodation at <http://www.carleton.ca/equity/>

**Use of Course Materials:**

Classroom teaching and learning activities, including lectures, discussions, presentations, etc., by both instructors and students, are copyright protected and remain the intellectual property of their respective author(s). All course materials, including PowerPoint presentations, outlines, and other materials, are also protected by copyright and remain the intellectual property of their respective author(s). Students registered in the course may take notes and make copies of course materials for their own educational use only. Students are not permitted to reproduce or distribute lecture notes and course materials publicly for commercial or non-commercial purposes without express written consent from the copyright holder(s).