

ENG PHYS 4U02B
Modern and Applied Physics Laboratory – Biomedical
Winter 2019
Course Outline

CALENDAR/COURSE DESCRIPTION

Selected advanced experiments in two areas of applied physics, chosen from among these unique topics: Photonics, Nano- and Micro-devices (Photovoltaics), Biomedical, and Nuclear Labs. Students must take ENGPYS 4U02 twice, in order to fulfill degree requirements (for a total of four units). Students must select two unique topics from the list above; the same topic cannot be repeated.

Two labs (three hours each); both terms

Biomedical: this course outline describes one of the four topics available in 4U02A/B. In this module, students will complete the fabrication and testing of a working MOSFET/ISFET using semiconductor fabrication methods.

PRE-REQUISITES AND ANTI-REQUISITES

Prerequisite(s): ENGPYS 3W04 A/B and PHYSICS 3B06, or both ENGPYS 3BA3 and ENGPYS 3BB3

Anti-requisite(s): ENGPYS 4U04 A/B

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

Dr. Rafael Kleiman
JHE A324
kleiman@mcmaster.ca
ext. 26290

Office Hours: By appointment

TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

Tim van Boxel
vanboxtj@mcmaster.ca

Office Hours: By appointment

COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

The course website, including all course information will be hosted on Avenue to Learn:

<http://avenue.mcmaster.ca/>

All course-related submissions must be done through Avenue to Learn Dropboxes.

It is the students' responsibility to check regularly the course web page (Avenue to Learn) for updates and announcements.

Students are required to obtain and maintain McMaster and Avenue to Learn e-mail accounts for timely communications between the instructors and the students.

COURSE OBJECTIVES

The objective of this course is to understand, fabricate, and test a semiconductor device that can be used in a wide range of biosensing applications. They will learn to fabricate devices using advanced multi-step semiconductor fabrication process flows. In addition, they will learn to develop the appropriate test setups to characterize and validate the device in the biomedical context.

By the end of this course, students should be able to:

- Understand the physics of MOSFETs/ISFETs
- Understand how to fabricate MOSFETs/ISFETs
- Understand basic semiconductor processes, such as photolithography, doping, deposition and etching
- Understand semiconductor device characterization techniques

MATERIALS AND FEES

Required Text:

N/A

Reference Text:

"Introduction to Microelectronic Fabrication: Volume 5 of Modular Series on Solid State Devices", Richard C. Jaeger, second edition, Prentice Hall, 2002

Calculator:

N/A

Other Materials:

A laboratory notebook (paper or electronic) is required.

COURSE OVERVIEW

The course consists of 12 laboratory sessions, 1 lab session per week, 3 hours each. The project will be performed in groups of 2-3; however the final reports will be submitted individually. The detailed weekly lab procedures are available in the lab manual posted in Avenue to Learn.

At certain points in the course it may make good sense to modify the schedule outlined above.

The instructor reserves the right to modify elements of the course and will notify students accordingly, both in class and on Avenue to Learn. Posted changes take precedence over this course outline.

ASSESSMENT*

Component	Weight	Due Date
MOSFET/ISFET fundamentals – quiz	20%	Week of February 5 th
Device Processing and Characterization – quiz	20%	Week of March 5 th
Fabrication – participation	20%	
Device Testing – participation	10%	
Final Report	30%	Monday, April 9 th , 2018, 11:59 pm
Total	100%	

*All students must be present during every lab session and participate in the lab activities to receive marks.

- Students are not allowed to participate in labs without attending the safety lecture (first part of lab 1) and submitting the safety quiz.
- All students must attend all labs. Students absent from the lab will lose 10% of the final grade per missed lab. At the end of every lab, the teaching assistants will check the experimental record of each student, which must be kept inside a bound laboratory notebook or dedicated lab notebook software.
- The quizzes will cover material related to the semiconductor processing performed in the lab and fundamentals of cell operation. The format of the quizzes will be oral, with a duration of 15-30 min, and conducted with your entire lab group.
- The final report will be in the style of a research paper, where you will report and discuss your experimental methods and results. The final report will be graded using the final report grading rubrics provided as a separate handout. Each student will submit their own report (no group reports). Every report is due before the time and date indicated. No extensions will be granted and late reports will not be accepted. All students must participate in the safety lectures/labs/information sessions indicated in each section's information sheet.

ACCREDITATION LEARNING OUTCOMES

The Learning Outcomes defined in this section are measured for Accreditation purposes only, and will not be directly taken into consideration in determining a student's actual grade in the course.

5.1, 5.2, 7.1, 7.2, 7.3, 12.1

For more information on Accreditation, please visit: <https://www.engineerscanada.ca>

ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of

credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at <http://www.mcmaster.ca/academicintegrity>

The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. Improper collaboration in group work.
3. Copying or using unauthorized aids in tests and examinations.

ACADEMIC ACCOMMODATIONS

Students who require academic accommodation must contact Student accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contact by phone at 905.525.9140 ext. 28652 or e-mail at sas@mcmaster.ca. For further information, consult McMaster University's Policy for [Academic Accommodation of Students with Disabilities](#).

NOTIFICATION OF STUDENT ABSENCE AND SUBMISSION OF REQUEST FOR RELIEF FOR MISSED ACADEMIC WORK

1. The [McMaster Student Absence Form](#) is a self-reporting tool for Undergraduate Students to report absences DUE TO MINOR MEDICAL SITUATIONS that last up to 3 days and provides the ability to request accommodation for any missed academic work. Please note this tool cannot be used during any final examination period.
2. You may submit a maximum of 1 Academic Work Missed request per term. It is YOUR responsibility to follow up with your Instructor immediately (NORMALLY WITHIN TWO WORKING DAYS) regarding the nature of the accommodation. Relief for missed academic work is not guaranteed.
3. If you are absent for reasons other than medical reasons, for more than 3 days, or exceed 1 request per term you MUST visit the Associate Dean's Office (JHE/A214). You may be required to provide supporting documentation.
4. This form must be submitted during the period of absence or the following day, and is only valid for academic work missed during this period of absence.
5. It is the prerogative of the instructor of the course to determine the appropriate relief for missed term work in his/her course.
6. You should expect to have academic commitments Monday through Friday but not on Saturday, Sunday or statutory holidays.
7. If you require an accommodation to meet a religious obligation or to celebrate an important religious holiday, you may submit the Academic Accommodation for Religious, Indigenous and Spiritual Observances (RISO) Form to the Associate Dean's Office. You can find all paperwork needed [here](#):

NOTICE REGARDING POSSIBLE COURSE MODIFICATION

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

COURSE POLICIES

1. It is the students' responsibility to regularly check the course web page (Avenue to Learn) for updates and announcements.
2. Students are required to obtain and maintain a McMaster e-mail account for timely communications between the instructor and the students.
3. You are expected to behave in a way that does not disrupt the learning experience of your peers. Disruptive behavior including making noise, leaving and entering the classroom, and use of cellular phones is forbidden and students presenting this type of behavior will be asked to leave the classroom.

TURNITIN.COM STATEMENT

In this course we will be using a web-based service (Turnitin.com) to reveal plagiarism. Students will be expected to submit their work electronically to Turnitin.com and in hard copy so that it can be checked for academic dishonesty. Students who do not wish to submit their work to Turnitin.com must still submit a copy to the instructor. No penalty will be assigned to a student who does not submit work to Turnitin.com. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, etc.). To see the Turnitin.com Policy, please go to <http://www.mcmaster.ca/academicintegrity/>.

ON-LINE STATEMENT FOR COURSES REQUIRING ONLINE ACCESS OR WORK

In this course, we will be using Avenue to Learn. Students should be aware that, when they access the electronic components of this course, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in this course will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure, please discuss this with the course instructor.

REFERENCE TO RESEARCH ETHICS

The two principles underlying integrity in research in a university setting are these: a researcher must be honest in proposing, seeking support for, conducting, and reporting research; a researcher must respect the rights of others in these activities. Any departure from these principles will diminish the integrity of the research enterprise. This policy applies to all those conducting research at or under the aegis of McMaster University. It is incumbent upon all

members of the university community to practice and to promote ethical behaviour. To see the Policy on Research Ethics at McMaster University, please go to

<http://www.mcmaster.ca/policy/faculty/Research/ResearchIntegrityPolicy.pdf>