

ENG PHYS 4Z03  
Semiconductor Manufacturing Technology  
Winter 2017  
Course Outline

CALENDAR/COURSE DESCRIPTION

Detailed description of fabrication technologies used in the semiconductor industry; computer modeling of device fabrication; analysis of device performance.

PRE-REQUISITES AND ANTI-REQUISITES

Prerequisite(s): ENGPYS 3F03 or 3F04; or MATLS 3Q03; and registration in the Faculty of Engineering

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

Dr. Leyla Soleymani  
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ext. 27204

Office Hours: By appointment

TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

M Cino  
[cinom@mcmaster.ca](mailto:cinom@mcmaster.ca)

Office Hours: By appointment

COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

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

COURSE ORGANIZATION AND COMPONENTS

The course includes one computer cluster-based lecture per week and one classroom-based lectures per week. The course includes the following components.

**Assignments** Two assignments will be presented by the instructor. These assignments will be posted on Avenue to Learn and will be due on the date specified. Assignments must be submitted individually. Late assignments will not be accepted and a grade of ZERO will be allocated.

**Examinations** Midterm exam on **Tuesday, 28 February 2017, 19:30-21:30 PM in room TBA**  
Final exam, cumulative, during exam period. This may include questions related to the computer-based lectures or student-lead oral presentations.

- Oral presentation** Oral presentations are in groups of 2 (individually for graduate students), topics need to be either from a suggested list provided by the instructor, or any other topic approved by the instructor. Presentations are evaluated individually for each presenter using the oral presentation rubrics.
- SILVACO Projects** SILVACO project reports are due individually through Avenue to Learn drop boxes on **Thursday, March 23<sup>rd</sup>** at 11:59 PM. Late projects reports will not be accepted and a grade of ZERO will be allocated.
- Lecture series** This course will feature a series of **compulsory** lectures presented by industry and academic leaders, who work in the areas “beyond the silicon roadmap”. Notice of the lectures will be provided in class and on the Avenue to Learn page at least one week in advance. **YOU MUST ATTEND ALL THE LECTURES IN ORDER TO OBTAIN FULL PARTICIPATION MARK.**

#### COURSE OBJECTIVES

The objective of this course is to give an introduction to the theory and technology of micro/nanofabrication. Two thirds of the course is lecture-based, where the theory of basic processing techniques from the formation of semiconductor wafer material to the finished device assembly will be discussed.

One third of the lectures will be based in a classroom PC cluster. The students learn to use state-of-the-art process simulators to virtually fabricate semiconductor chips and subsequently test their electronic properties.

At the end of the course, the students should have a good understanding of the various processing techniques used to micro/nano fabricate semiconductor devices; and to be able to simulate these processes using process simulators.

#### MATERIALS AND FEES

**Required Text:**

"Silicon VLSI Technology", J D Plummer, M D Deal, and P B Griffin, Prentice-Hall, 2000

**Reference Text:**

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

**Calculator:**

Only the McMaster Standard Calculator will be permitted in tests and examinations. This is available at the Campus Store.

#### COURSE OVERVIEW

Date/Week	Topic	Readings
1	Introduction to Semiconductor Technology, Review of Semiconductor Physics	Chapter 1
2	Semiconductor Device Background	Chapter 1

3	CMOS Technology	Chapter 2
4	Crystal Growth and Wafer Fabrication	Chapter 3
5	Cleanrooms and Lithography	Chapter 4, 5
6	Lithography	Chapter 5
7	Oxidation	Chapter 6
8	Study Break	
9	Diffusion	Chapter 7
10	Ion Implantation	Chapter 8
11	Ion Implantation and Thin film Deposition	Chapter 8, 9
12	Thin Film Deposition	Chapter 9
13	Student Presentations	
14	Student Presentations and Review	

#### ASSESSMENT\*

Component	Weight
Participation**	5%
Assignments	5%
Midterm Exam	20%
Oral Presentation	10%
SILVACO Project	20%
Final Exam	40%
Total	100%

\*This applies to students registered in 4Z03 only. 6Z03 students will be evaluated as (Assignments 5%, Midterm 20%, Oral Presentation 10%, Silvaco project 25%, Final exam 40%)

\*\*The participation grade will be calculated based on participation in the classroom-based and computer-based sessions and student-lead oral presentations.

#### ACCREDITATION LEARNING OUTCOMES

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

##### Outcomes

##### Indicators

The students will learn the engineering processes involved in semiconductor manufacturing (1.4, Midterm, Final)

The students will learn to apply appropriate mathematical techniques to model semiconductor fabrication processes (2.2, Final)

The students will learn to select the appropriate physical models for predicting the outcome of semiconductor processes and will learn to identify assumptions and constraints (3.2, Midterm, Final)

The students will learn to recognize and follow an engineering design process to design a process flow for fabricating a semiconductor device (4.1, SILVACO)

Report)

The students will learn to propose solutions to open-needed problems during their SILVACO project focused on designing a process flow for fabricating a semiconductor device (4.3, SILVACO Report)

The students will learn to use state-of-the-art semiconductor processing software (5.2, SILVACO Report)

The students will demonstrate an ability to respond to technical and non-technical questions through implementing their design project and preparing their final reports (7.1, SILVACO Report)

The students will learn to present information clearly and concisely as appropriate to the audience (7.2, Oral Presentation)

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For more information on Accreditation, please visit: INSERT URL.

#### 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](mailto: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 Saturday but not on Sunday or statutory holidays. 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: <http://www.eng.mcmaster.ca/current/documents.html>

#### 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.

**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/Conduct/ResearchEthicsPolicy.pdf>.