ECE 611 / CHE 611: Electronic Materials Processing
Fall 2019
Lectures: Tuesday, Thursday 10:00am – 11:20 am
Kearney Hall 124

Instructor

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- Office Hours: Monday 13:00 – 14:00.

Course Website

- http://classes.engr.oregonstate.edu/eecs/fall2019/ece611.
- This will serve as the primary source of course information.
- It will be updated frequently (multiple times per week).
- Lecture notes will be uploaded here after each lecture.
- Homework and solutions will be posted on the website.

Textbook

- Silicon Processing for the VLSI Era, Volume 1: Process Technology. Stanley Wolf, Richard N. Tauber (1986), Lattice Press.
- https://www.amazon.com/Silicon-Processing-VLSI-Era-Vol/dp/0961672137.

Assessment

- The final grade will consist of the following contributions:

Assessment	Percentage of Final Grade
Homework	40
Mid-Term Exam	20
Term Paper	20
Final Exam	20

- The grade boundaries are:

Lower Bound (%)	Upper Bound (%)	Grade
93	100	A
90	92	A-
87	89	B+
83	86	B
80	82	B-
77	79	C+
73	76	C
70	72	C-
67	69	D+
63	66	D

- Percentages will be rounded-off to the nearest whole percent to determine letter grade.

Lectures

- The lectures are **compulsory** to attend.
- There will be two 80 minute lectures: Tuesday and Thursday 10:00 am – 11:20 am.
- Some lecture slots will be left open to provide you time to prepare for examinations etc.
    - Additional (ungraded) problems will be provided in the place of lectures in these cases.
- The slides will be provided online after each lecture.
- Physical copies will be provided at the start of all lectures.
    - You are expected to make notes on the slides of any extra / contextual information that is not written down.

Homework

- There will be a total of **4 homeworks**.
- The homeworks overall contribute 40% of the course grade.
    - 10% each.
- The homeworks are designed to test your understanding of the concepts covered in the lectures.
    - Sometimes you will be expected to apply knowledge obtained in the lectures to new (previously unseen) situations.
- You will be assessed via a mixture of:
    - **Text-based answers**. I.e. you will be expected to describe a process or phenomenon in words.
    - **Analytical problems**. Derivations and/or calculations that can be solved with just pen, paper, and calculator.
    - **Data analysis**. You will be provided with some simple numerical data (e.g. in .csv format) and expected to process it to extract parameters / draw conclusions.
    - **Simulations**. You will be given instructions and expected to use software (Silvaco Athena) to simulate growth and predict certain properties of electronic materials.
- Homework will be due **1 week after it is set**.
- Please hand in homework at the start of the lecture on the due date.
    - Please make your name and OSU ID clearly visible.
- Late homework will be **deducted 10% per day late** for a maximum of 5 days, after which the homework grade **will be zero**.
    - E.g. if you scored 85% on a homework, but you hand it in 2 days late, you will receive a grade of 65%.
- The solutions will be posted online when the homeworks are returned.
- The homework schedule is as follows (**subject to change**):

Homework #	Set	Due	Returned
1	Tuesday 10/08/19	Tuesday 10/15/19	Tuesday 10/22/19
2	Tuesday 10/22/19	Tuesday 10/29/19	Tuesday 11/05/19
3	Tuesday 11/05/19	Tuesday 11/12/19	Tuesday 11/19/19
4	Tuesday 11/19/19	Tuesday 11/26/19	Friday 12/13/19

Examinations

- There will be two examinations: one midterm, one final.
- They will carry equal weight to the final course grade: 20% each.
- The midterm will examine content covered in Lectures 1-8 (inclusive).
- The final will examine content covered in Lectures 9-16 (inclusive).
- The exams will consist of optional questions. For example, you may be expected to complete 2 out of 3 questions.
- The exams are designed to test your ability to apply knowledge acquired during the exams to new (previously unseen) situations.
- You will be allowed (and expected) to use a calculator.
- Both exams will be **closed book** and **closed notes**.
- Besides a small number of well-known equations, most equations will be provided at the start of the exam.
- All physical constants and parameters will be provided.
- The exams will take place in Kearney Hall 124.
- The exams will last 80 minutes.
    - Please ensure you arrive on time so the exams can begin promptly.
- The below schedule is provisional and **subject to change**:

Exam	Week	Date	Time
Midterm	5	Tuesday 10/29/19	10:00 am
Final	F	Friday 12/13/19	09:30 am

Term Paper

- As part of this course you will **be expected to write a term paper** based on a topic related to electronic materials processing.
- This can be viewed as a concise literature review.
- The paper will be 4 – 5 pages (excluding references).
- Details and regulations for the report are available from the course website: http://classes.engr.oregonstate.edu/eecs/fall2019/ece611/termpaper.html.
- You will be given a choice of topics on Tuesday October 29th, and be expected to provide a ranked list of your top 5 topics by **5pm on Friday November 1st**.
- The due date for the term paper is **Tuesday 11/19/19**.

Simulations

- In addition to the lecture component to this course, you will be expected to carry out some simulation / modeling using Athena / SUPREM packages.
- Athena is a simulation package designed to simulate the growth of electronic materials, for use by the microelectronics industry.
- The simulations will be discussed in Lectures 9 and 10.
- These simulations will be the subject of Homework 3.

Lecture Schedule

- The below schedule is provisional and **subject to change**.

Lecture	Week	Day	Date	Month	Subject
1	0	Thur	26	Sep	Introduction
2	1	Tue	1	Oct	Silicon Properties and Growth
3	1	Thur	3	Oct	Vacuum Science and Technology
4	2	Tue	8	Oct	Electrochemical Deposition of Metals
5	2	Thur	10	Oct	Plasmas
6	3	Tue	15	Oct	Oxidation
7	3	Thur	17	Oct	Diffusion
8	4	Tue	22	Oct	Ion Implantation
	4	Thur	24	Oct	No Lecture - Preparation for Midterm
	5	Tue	29	Oct	Midterm
9	5	Thur	31	Oct	Modeling with Athina 1
10	6	Tue	5	Nov	Modeling with Athina 2
11	6	Thur	7	Nov	CVD
12	7	Tue	12	Nov	Thin Film Growth
13	7	Thur	14	Nov	Basic Photolithography
14	8	Tue	19	Nov	Advanced Photolithography
15	8	Thur	21	Nov	Etching
16	9	Tue	26	Nov	The Future of Electronics
	9	Thur	28	Nov	No Lecture - Thanksgiving
	10	Tue	3	Dec	No Lecture - John at Conference
	10	Thur	5	Dec	No Lecture – Preparation for Final
	F	Fri	13	Dec	Final Exam