

EERT 22095: Introduction to Semiconductor Manufacturing Technology
Summer -2024
Flavia P.N.Inbanathan Ph.D.

COURSE INFORMATION

Class Meeting.....TBA
Phone/E-mail Teams Call Only/ finbanat@kent.edu
Office Hours By appointment

CATALOG DESCRIPTION

Special topics of immediate interest in Semiconductor Manufacturing technology
Semiconductor Manufacturing will introduce students to the fundamentals of microchip fabrication. This course will explore the steps in the manufacturing process from an engineering and manufacturing technology viewpoint

RECOMMENDED REFERENCES

- Nanohub.org; Nano4me.org; ohiolink.oercommons.org

RECOMMENDED TEXT

- Hwaiyu Geng.; Semiconductor Manufacturing Handbook 2nd Edition, ISBN: 9781259587696, 2018, McGraw-Hill

PRE-REQUISITES: NONE

COURSE LEARNING OBJECTIVES (CLOS)

The following table lists the course learning objectives and how they support student outcomes as well as meet the university's experiential learning requirement.

Upon successful completion of this course, students will be able to:

1. Discuss the history and impacts of the semiconductor industry as they relate to modern semiconductor manufacturing.
 2. Describe the process flow of semiconductor fabrication.
 3. Explain the fundamental principles that apply to semiconductor manufacturing processing steps
 4. Describe the operational principles of typical equipment used in the semiconductor manufacturing process.
 5. Describe the impacts of defects and contamination on the process of semiconductor manufacturing.
 6. Apply problem solving skills to challenges in the manufacturing process including, process control, various troubleshooting techniques, and process development.
 7. Communicate technical information related to the semiconductor manufacturing process within a team or to the wider scientific community.
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COURSE OUTLINE

The course outline is subject to change throughout the semester. It is the responsibility of the faculty member to notify students of changes; it is the responsibility of the student to keep track of adhering to the changes. Check your email and course announcements frequently!

ASSESSMENT

Requirement	Points
Homework, Quiz	(20%)
Take-Home Exams	(50%)
Project and Final Presentation	(30%)
Total	

Homework: There will be homework following each topic that is due at the start of the following class period. Each homework assignment will include a problem-solving aspect and a written summary of key ideas from the lesson.

Quiz: There will be periodical quiz to test the concepts that are introduced throughout the course.

Take-Home Exams: There will be four total take-home exams offered following Lithography, Ion Implantation, Atomic Layer Deposition, and Etching. Details and due dates regarding the exams will be provided in future documents.

Final Presentation: These will occur on the last day of the term. Presentations will be done as a team and all teammates must participate. Further details including a grading rubric, content, and format of the presentation will be provided in future documents.

Deadlines: Find a mechanism that works best for you to keep track of the deadlines, whether that is a calendar on your phone or using some sort of planner. If you need any flexibility in deadlines due to unforeseen circumstances, then communicate with me.

Extra help: If you are willing to learn the course contents to become successful, then reach out to me for extra help, if any you need. Happy to Help.

GRADE SCALE

Letter Grading		Letter Grade
Percentage Range (%)		
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+
60	66	D
< 60		F

Enrollment/Official Registration:

<u>Registration Transactions</u>	<u>Deadlines</u>	<u>Registration Transactions</u>	<u>Deadlines</u>
Session Start Date	05/28/24	Session End Date	06/30/24
Last Day to Add	05/29/24	Last Day to Withdraw	06/17/24
Last Day to Drop	05/31/24		

University policy requires all students to be officially registered in each class they are attending. Students who are not officially registered for a course by published deadlines should not be attending classes and will not receive credit or a grade for the course. Each student must confirm enrollment by checking his/her class schedule (using Student/Dashboard/Today's Class Schedule [View Full Schedule] menu in FlashLine) prior to the deadline indicated. Registration errors must be corrected prior to the deadline.

Attendance:

Attendance is required. The course is designed in such a way that you need to attend the class in order to understand the concepts and to succeed in the course. It is the student's responsibility to obtain the missed class materials and make up missed tests and quizzes. If you are going to miss any class due to unavoidable reasons, let your instructor know in advance and do not forget to check the lecture notes and announcements posted in the Canvas. No make-up for FINAL EXAMS/FINAL PROJECT. No Late work acceptance policy. Any assignment or project/ lab reports submitted after submission due WILL NOT BE considered towards final grade.

Academic presence verification statement:

In compliance with federal regulations, the University is required to report that enrolled students have participated in at least one academically related activity. If no academic activity is submitted by the end of the fourth week of the semester (for a full-term course) then a grade of NF (Never attended F) will be assigned. The NF mark will count as an F in computing grade point averages. Students who have received an NF mark will lose their access to Canvas.

To avoid an NF mark, students must participate in at least one academic activity as soon as possible and no later than the end of the fourth week. Examples of some of the acceptable academically related activity are: physically attended the course (does not apply to online courses), submitted an academic assignment, completed an interactive tutorial, initiated contact with the instructor to ask a question about the academic subject matter, submitted an exam or quiz, participated in an online discussion about academic matters.

Notice of Copyright and Intellectual Property Rights:

Any intellectual property displayed or distributed to students during the course (including but not limited to PowerPoints, notes quizzes, examinations, etc.) by the instructor remains the intellectual property of the instructor. This means the student may not distribute, publish, or provide such intellectual property to any person or entity for any reason, commercial or otherwise without the instructor's written permission.

Subject to Change Statement

The syllabus and course schedule may be subject to change. Changes will be communicated in advance in class and/or through Canvas announcements.

Academic Cheating and Plagiarism:

University policy 3-01.8 deals with the problem of academic dishonesty, cheating, and plagiarism. None of these will be tolerated in this class. The sanctions provided in this policy will be used to deal with any violations. If you have any questions, please read the policy at <http://www.kent.edu/policyreg> and/or ask.

Class Cancellations & Campus Closings:

In the case of an emergency, weather-related or otherwise, please check the website at <http://www.kent.edu/trumbull> for information on class cancellations and/or campus closings. Students may also subscribe to Flash ALERTS, Kent State's official emergency text notification system to alert subscribers of critical information no matter what time it is or where they are in the world. Flash ALERTS expands the university's ability to send critical news and information to the university community during campus emergencies. Students may sign up for Flash ALERTS at <http://www.kent.edu/flashalerts>

Students with Disabilities:

Kent State University is committed to inclusive and accessible education experiences for all students. University Policy 3342-3-01.3 requires that students with disabilities be provided reasonable accommodations to ensure equal access to course content. Students with disabilities are encouraged to connect with Student Accessibility Services as early as possible to establish accommodation. If you anticipate or experience academic barriers based on a disability (including mental health, chronic medical conditions, or injuries), please contact Elaine Shively at eshively@kent.edu or at 330.675.8932.

Diversity Statement

"Kent State University is committed to the creation and maintenance of equitable and inclusive learning spaces. This course is a learning environment where all will be treated with respect and dignity, and where all individuals will have an equitable opportunity to succeed. The diversity that each student brings to this course is viewed as a strength and a benefit. Dimensions of diversity and their intersections include but are not limited to: race, ethnicity, national origin, primary language, age, gender identity and expression, sexual orientation, religious affiliation, mental and physical abilities, socio-economic status, family/caregiver status, and veteran status."

Request for Religious Accommodations

The University welcomes individuals from all different faiths, philosophies, religious traditions, and other systems of belief, and supports their respective practices. In compliance with University policy and the Ohio Revised Code, the University permits students to request class absences for up to three (3) days, per semester, in order to participate in organized activities conducted under the auspices of a religious denomination, church, or other religious or spiritual organization. Students will not be penalized as a result of any of these excused absences.

The request for excusal must be made, in writing, during the first fourteen (14) days of the semester and include the date(s) of each proposed absence or request for alternative religious accommodation. The request must clearly state that the proposed absence is to participate in religious activities. The request must also provide the particular accommodation(s) you desire.

You will be notified by me if your request is approved, or, if it is approved with modification. I will work with you in an effort to arrange a mutually agreeable alternative arrangement. For more information regarding this Policy you may contact the Student Ombuds (ombuds@kent.edu).

Word of Advice: How to Succeed in This Class?

- Attend classes regularly. Regular attendance is very important for this course. If you are going to miss any class due to unavoidable reasons, please let me know in advance and do not forget to check the lecture notes and announcements posted in the Canvas. It is the responsibility of students to make up for the work missed during absences.
- Dedicate adequate study time after the class. This course will require a lot of solving problems related to circuit design. You will need to dedicate more practice time to be proficient at this important course.
- Complete the HW-assignments, Lab experiments and turn them in on time. If you do not pay proper attention to these assignments, doing good only during tests and final exam will not ensure a good grade. Please note that late assignments will not be accepted without prior permission.
- Never hesitate to contact me. If anything is not clear about the course material or if you have any other issues about the class, feel free to contact me any time. In case you cannot come to my office during the specified office hours, I will be happy to arrange an alternative time for you.

ST 22095: Introduction to Semiconductor Manufacturing Technology
Tentative Lecture Schedule

Date	Topic	Assessment
28-May	Introduction, Syllabus, History of Semiconductors	
29-May	What is a transistor? How does it work? Why do we need to make them? Lab Activity, construct simple circuits using semiconductor devices	Quiz-1
30-May	Introduction to CMOS Fabrication & Process Flow	
31-May	Why do we need vacuums? Types of vacuums. Vacuum system design	
3-Jun	Water Systems and Wafer Cleaning, Chemistry involved in Fabrication process	Quiz-2
4-Jun	Tour KDI	
5-Jun	Lithography - Spin Coating & Photoresists	
6-Jun	Lithography - Exposure & Development	Quiz-3
7-Jun	Thermal Oxidation of Si, Doping & Ion Implantation	
10-Jun	Physical Vapor Deposition	
11-Jun	Chemical Vapor Deposition	
12-Jun	Wet Etching	
13-Jun	Dry Etching	Quiz-4
14-Jun	Intel Site Visit - Careers @ Intel, Pathways, Day-in-the-life, speed networking	
17-Jun	Atomic Layer Deposition	
18-Jun	Chemical & Mechanical Polishing	
19-Jun	<i>Juneteenth Holiday</i>	
20-Jun	Back End Processing	
21-Jun	Advanced Nanofabrication Concepts	Quiz-5
24-Jun	Tour Alpha Micro/Hanna Microdisplays	
25-Jun	Automated Manufacturing and Robotics	
26-Jun	PCB manufacturing and soldering/Professional training session	
27-Jun	Micro Electromechanical Systems & Review of Process Flow	
28-Jun	Presentations	

Note to the student: In a 5-week term, every day of class is approximately two days during a 15-week spring or fall term.

FINAL EXAM

The final exam period is Friday June 28th 2024. Instead of taking a final exam, student final assessment will be in the form of a summative project. Course final reporting is also due at the final exam period.