KENT STATE UNIVERSITY
College of Aeronautics & Engineering

ENGT 33095: Semiconductor Manufacturing and Processing
Summer -2024
David J. Kirby Ph.D.

COURSE INFORMATION

Class Meeting ..... TBA
Office Location ..... By appointment
Phone/E-mail ..... Teams Call Only/ dkirby5@kent.edu
Office Hours ..... By appointment

CATALOG DESCRIPTION

Special topics of immediate interest in engineering 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 viewpoint using the relevant calculus, physics, and chemistry concepts.

RECOMMENDED REFERENCES

- Nanohub.org
- Nano4me.org

REQUIRED TEXT

- Geng, H.; Semiconductor Manufacturing Handbook 2nd Edition, 2018, McGraw-Hill

PRE-REQUISITES

- General Chemistry I
- Physics II
- Calculus I

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.

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!

Date	Topic
28-May	Introduction, Syllabus, History of Semiconductors
29-May	What is a semiconductor? How is it different from a conductor or insulator? How can we modify the properties of a semiconductor? How does a semiconductor allow a transistor to operate?
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
4-Jun	Tour KDI
5-Jun	Lithography - Spin Coating & Photoresists
6-Jun	Lithography - Exposure & Development
7-Jun	Thermal Oxidation of Silicon
10-Jun	Doping
11-Jun	Ion Implantation
12-Jun	Physical Vapor Deposition
13-Jun	Chemical Vapor Deposition
14-Jun	Intel Site Visit - Careers @ Intel, Pathways, Day-in-the-life, speed networking
17-Jun	Atomic Layer Deposition
18-Jun	Wet Etching
19-Jun	Juneteenth Holiday
20-Jun	Dry Etching
21-Jun	Chemical & Mechanical Polishing
24-Jun	Tour Alpha Micro/Hanna Microdisplays
25-Jun	Back End Processing
26-Jun	Advanced Nanofabrication Concepts
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.

ASSESSMENT

Requirement	Points
Homework	(10%)
Take-Home Exams	(60%)
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.

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.

GRADE SCALE

A	≥ 90%	C	≥ 70.0 and <76.5%
B+	≥ 86.5 and < 90%	D	≥ 60.0 and <70%
B	≥ 80.0 and < 86.5%	F	< 60.0
C+	≥ 76.5 and < 80%		
