Semiconductor Devices Course Syllabus EECE 2077

Fall Semester 2024

This syllabus is subject to modification.

INSTRUCTOR: Professor Chong H. Ahn
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TA and Grader: **Samiur Khan** (TA, PhD student in Semiconductor Devices):
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Zihan Wang (Grader):
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LECTURES: **Rec Center 3200**, 12:30 PM to 1:50 PM Tuesdays & Thursdays
This course is a **face-to-face**, in-person course.

REQUIRED TEXTBOOKS:

(1) Solid State Electronic Devices, Ben G. Streetman, Sanjay Kumar Banerjee, 7th Edition, 2015. Pearson, ISBN 13: 978-0-13-335603-8
(2) Semiconductor Physics and Devices, Donald A. Neaman, 4th Edition, 2012. McGraw-Hill, ISBN 978-0-07-352958-5

COURSE GOAL: The goal for Semiconductor Devices is to introduce the basics of semiconductor physics and devices which includes quantum mechanics, equilibrium, static characteristics, biasing, carrier flow and small-signal models of pn-junctions and transistors. Students are expected to acquire about the fundamental of pn-junctions, Schottky diodes, field effect transistors (FET), bipolar junction transistors (BJT), MOSFET and photodiodes.

EXAMS: This course will have three 110 minutes long exams: Two exams are scheduled during the semester (see Course Schedule below) and the final exam is scheduled as UC final exam schedule. These exams will consist of problems and questions similar to **homework problems**, examples from the text, and problems and questions discussed in class.

First Exam: Thursday, October 3
Second Exam: Thursday, November 14
Final Exam: As the final exam schedule.

The format of all exams is OPEN books and class notes/materials. All face-to-face exams will be given in our regular classroom, **Rec Center 3200.** Exam I and Exam II will be given during regularly scheduled class times. Cell phones and personal communications are not allowed during examination, only allowing to access all the class materials using your personal computer or iPad. There is no restriction on calculators, except smart phone calculators. There will be no make-up examination and a grade of zero will be given for any missed exams for which there have been no arrangements made ahead, unless you have a written medical excuse.

QUIZZES: No quizzes.

HOMEWORK ASSIGNMRNT:
Homework problems will be assigned periodically and will be due a week from the date they are assigned. They will be graded and returned.

I will return the graded homework in class. In case the student does not agree with the grading points received for the solution she/he should contact the grader (TA, Samiur Khan) to resolve the disagreement. Contact me if the disagreement cannot be resolved.

OASIS TRAINING (***Ohio-southwest Alliance on Semiconductors and Integrated Scalable-Manufacturing INTEL Corporation***)**:**
You will be asked to take about 12 hrs of micro-credentials on a separate canvas website which constitute a bird's eye view of semiconductor fabrication. These 12 hrs will be split into 3 modules.

- Module 1: Introduction to Semiconductor Processing Environment (Cleanroom)
- Module 2: Chemical Safety in Semiconductor Processing
- Module 3: Introduction to IC Fabrication Processes and Metrology

Each module has a series of quizzes which you will need to answer as part of the grade for this section of the class. In addition, you will need to participate in a 3 hr clean room session with Ron Flenniken in the Mantei Center. The OASiS training section will count for 10 % of your grade for the class. Further details of these sessions will be posted separately.

ATTENDANCE: You are required to attend all classes except for emergencies.

RELIGIOUS ACCOMODATIONS:
Ohio law and the University's Student Religious Accommodations for Courses Policy 1.3.7 permits a student, upon request, to be absent for reasons of faith or religious or spiritual belief system or participate in organized activities conducted under the auspices of a religious denomination, church, or other religious or spiritual organization and/or to receive alternative accommodations with regard to examinations and other course requirements due to an absence permitted for the above-described reasons. Not later than fourteen days after the first day of instruction in the course, a student should provide the instructor with written notice of the specific dates for which the student requests alternative accommodations. For additional information about this policy, please contact the Executive Director of the Office of Equal Opportunity and Access at (513) 556-5503 or oeohelp@UCMAIL.UC.EDU.

CONDUCT: The University Rules, including the Student Code of Conduct (SCC), and other documented policies of the department, college, and university related to academic integrity will be enforced. Any violation of these regulations, including acts of plagiarism or cheating, will be dealt with on an individual basis according to the severity of the misconduct. Unless explicitly stated, the SCC applies to any assignment that counts towards a student's course grade.

WITHDRAWAL: Check Catalyst for the last day to withdraw from this course and receive a "W" grade.

GRADING: Grade for the course will be determined by your performance on the (i) 2 mid-term exams (100 points each, for a total of 200 points); (ii) Final exam (120 points); (iii) Homework (40 points) and OASiS training (40 points, 10%). An aggregate percent score will be obtained out of the max points of 400 (100%). The Final grade for the course will be obtained by curving your aggregate score.

Please note that Point Totals (or Average) shown on the CANVAS Grade book ARE NOT CALCULATED using the Grading Scheme listed above, and therefore do not correspond to

student's actual Course Score. However, points for individual assignments (*homework assignments and exams*) displayed in the CANVAS Grade Book correspond to student's correct score on these assignments. Individual assignment scores are usually displayed on a maximum 10-point scale. Letter grades for the course will be assigned using the following approximate guidelines:

$x \geq 93$	A
$90 \leq x < 93$	A-
$87 \leq x < 90$	B+
$83 \leq x < 87$	B
$80 \leq x < 83$	B-
$77 \leq x < 80$	C+
$73 \leq x < 77$	C
$70 \leq x < 73$	C-
$67 \leq x < 70$	D+
$63 \leq x < 67$	D
$60 \leq x < 63$	D-
$x < 60$	F

Topic to be Covered

1. Crystal Structure of Solids (Week 1)
2. Intro. Quantum Mechanics (Week 2)
3. Quantum Theory applied to Solids (Week 3)
4. Semiconductors in Equilibrium (Week 4)
5. pn-Junctions (Week 5)
6. pn-Junctions, Metal Semiconductor Junction (Week 6-7)
7. Junction Field Effect Transistors (JFET) (Week 8-9)
8. MOSFET (Week 10-12)
9. Bipolar Junction Transistors (BJT) (Week 13-14)
10. Photodiodes (Week 15)