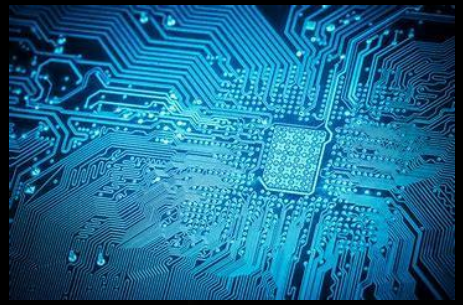
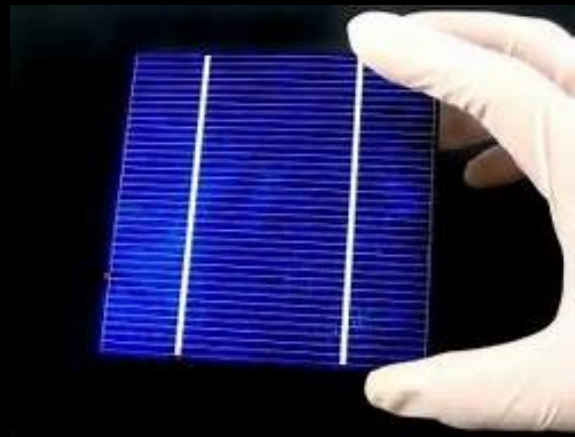
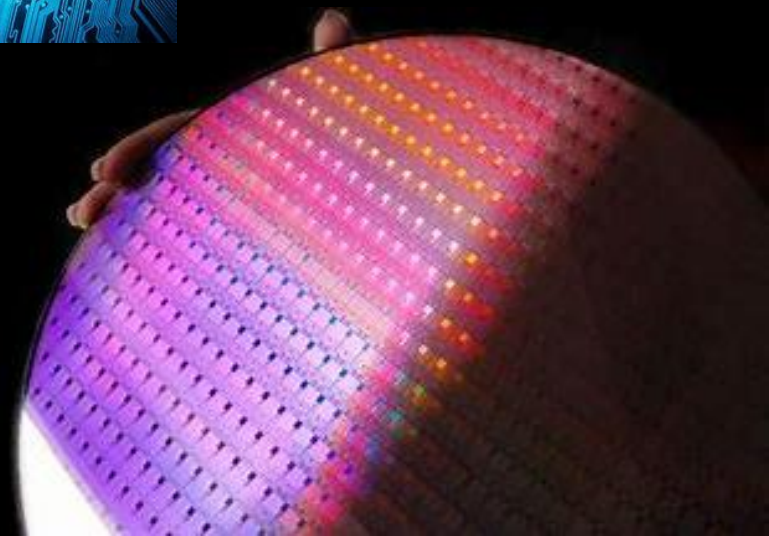
Semiconductor Devices

Course practicalities







Hele Savin, Ville Vähänissi

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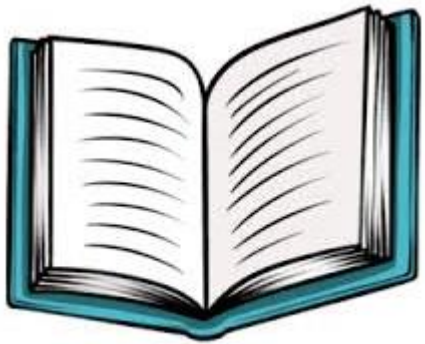
Course material

Written material / Everything available online and links in MyCo

1. Chenming Calvin Hu "Modern Semiconductor Devices for Integrated Circuits", Pearson Education (2010) - chapters 3-6 (https://www.eecs.berkeley.edu/~hu/Book-Chapters-and-Lecture-Slides-download.html)
2. https://www.pveducation.org/ - chapters 1, 3-6, 8
3. Simon Sze “Semiconductor Devices – Physics and Technology, 3rd ed, Wiley 2013 – chapter 10.1.
4. Lecture slides



Contact information

Lecturers: Hele Savin, Ville Vähänissi

Course assistants: Check MyCo **Syllabus**

Email: firstname.surname@aalto.fi

Main course activities (workload %)

Online lectures (video recordings) ~ 25%

Available any time

Live teaching event with teachers present ~ 25%

Fixed times on Mon and Wed

Written exercises to be done individually at home ~ 45 %

Oral exercises to be done with teachers present ~ 5%

Course evaluation is based on these. Follow the deadlines.

Oral exam at the end (optional)

Student task A

Watch the lectures

- The first lecture is on campus (today 8.1.2024)
- Two guest lectures on campus (Okmetic 10.1., Ametek 31.1.), will be recorded too
- All the rest of the lectures are pre-recorded and can be watched individually at any time (check the recommended order and related exercise deadlines in MyCo)
- There are altogether 9 “main” video lectures, some of them are divided into 2-3 parts
- There are also additional video lectures recorded in previous years by the company representatives (this is considered extra material)
- All lecture links are available in MyCo

Student task B

Quizzes related to the video lectures

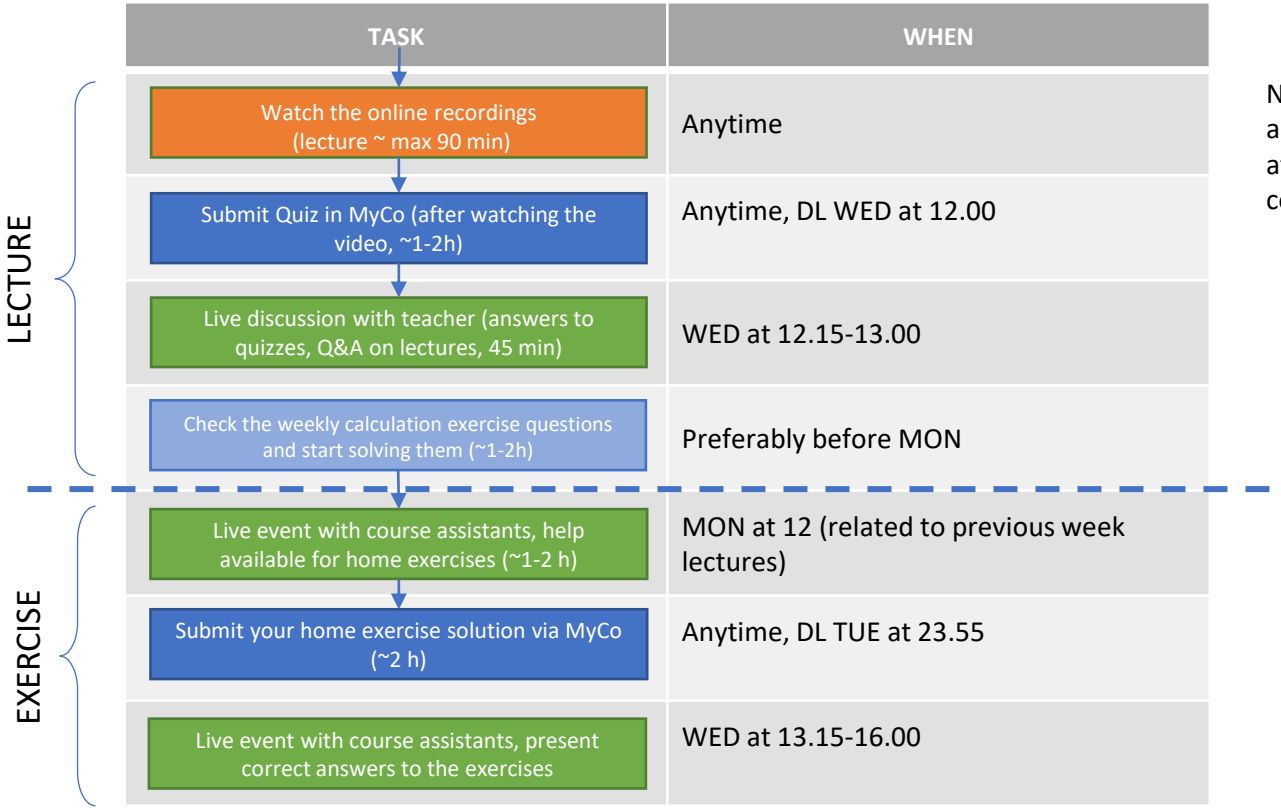
- **A set of multiple-choice questions to be done individually** in MyCourses **after watching** every lecture recording (lectures 2-10).
- The purpose is that the student recaps the main points from the lecture. Some of them are easier, some of them are more difficult
- It might be a good idea to check the quizzes (and course book) already before watching the lectures to orient one's mind for the topic
- When submitting quiz answers you have only one try → think carefully.
- DL 12:00 on WED before the corresponding LIVE Q&A session (**Note: two quizzes / week**)
- The earned points will be revealed immediately in MyCo after submitting the answers. The correct answers will be discussed during the WED live Q&A session lead by the teacher
- Each set worth of 3 p → total number of points available 9 x 3 p = 27 p

Student task C

Calculation exercises

- In total 4 calculations exercise sets
- **A set of calculation questions** every week (collaboration and discussion with peers encouraged)
- Separate exercise contact teaching sessions organized on Mon afternoon
  - During the exercise sessions assistant's and co-students' help is available prior to submission DL
  - Highly recommended but not obligatory
- Exercises will be available well in advance and students are advised to try to solve them beforehand
- The exercises should be submitted to MyCo by TUE 23:55
- At the beginning of exercise session (WED) each student will mark in the table which exercises they have managed to solve and **are willing to present at the white board** (to get points). The solution is discussed with the teacher.
- Total number of points available: 4 x 10 p = 40 p

Example “timeline” for each lecture topic



Note: MyCo gives you automatically points for the quiz after submission (but not the correct answers).

Student task D

Group exercise

- There will be one **group work session** at the end of the course. This session will revise some of the topics discussed during the course and helps to prepare for the final tasks. Attendance and active participation in the group work during the session is worth of 5 exercise points.
- Total number of points available: 5 p

Student task E

Discussion exercise

- This exercise measures more your understanding of the topics rather than memorizing of things.
- 1-2 topics discussed in an **informal session** with the teachers.
- A pool of topics from which the discussion items will be randomly selected will be published in MyCourses well in time before the exercise.
- A whiteboard can be used in the discussion, but no slides, notes or other material is allowed.
- To be done in pairs
- Time slot: 15 min / pair, **to be scheduled in MyCourses.**
- Total number of points available 28 p

Summary for the student tasks & grading

The recommended path (no oral exam)

Assignment type	Details	Max. points available	Min. points needed to pass the course
Quizzes	Multiple-choice questions, automatic grading. To be done in MyCourses after watching each lecture 9 x 1.67 p	27	5
Calculation exercises	“Traditional” calculation exercises, weekly help available on Mon afternoon. To be done weekly. 4 exercises to be submitted (4 x 4p)	40	10
Group exercise	One group exercise at the end of the course.	5	
Discussion exercise	To be done at the end of the course.	28	5
Bonus	Answering to student feedback poll.	+3	-
TOTAL		**100 (+3)**	**-**

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Note that 20 p. in the right column is not the limit for passing the course, but the 3-5 p. limit is a threshold for each task.

- Points from each part will be summed together and grading is based on total points earned.
- Point limits for each grade will be announced close to the end of the course.

Alternative path to pass the course

Oral exam only

- The final course grade will be based 100 % on the final oral exam.
- Traditional written exam is held once during autumn
- Please contact the teachers well in time if you are planning to take this option.

Schedule

W	Monday – on campus	To do at home before Wed	Wednesday – on campus	To do at home before next Mon
2	Introduction	Si material properties		Metal-semiconductor junctions
	Introduction lecture at 12:15 – 14 - Course practicalities - Introduction to the course topics	• Watch the following lecture videos: - Semiconductor physics (recap of pre-requisite) - Si material properties	Guest lecture at 12:15 – 13 - Lecturer from Okmetic Inc. - Si ingot and wafering	• Watch the following lecture video: - Metal-Semiconductor junctions • Start preparing the exercise set 1 (Ex1) and quizzes 1-2
3	Si material properties and metal-semiconductor junctions			Silicon solar cells
	Exercise session 1 at 12:15 – 14 - Help available by TAs	• Submit lecture Quiz 1 & Quiz 2 (DL Wed at noon) • Finalise the exercise set 1	Recap of lectures and quizzes at 12:15 – 13 • Prepare to present the correct answers for Ex1 at 13:15	• Watch the following lecture videos: - Silicon solar cells I & II • Start preparing the exercise set 2 (Ex2) and quizzes 3-4
4	Silicon solar cells			Device fabrication and detectors
	Exercise session 2 at 12:15 – 14 - Help available by TAs	• Submit lecture Quiz 3 & Quiz 4 (DL Wed at noon) • Finalise the exercise set 2	Recap of lectures and quizzes at 12:15 – 13 • Prepare to present the correct answers for Ex2 at 13:15	• Watch the following lecture videos: - Semiconductor device fabrication - Semiconductor detectors • Start preparing the exercise set 3 (Ex3) and quizzes 5-6
5	Device fabrication and detectors			MOS and MOSFETs
	Exercise session 3 at 12:15 – 14 - Help available by TAs	• Submit lecture Quiz 5 & Quiz 6 (DL Wed at noon) • Finalise the exercise set 3	Recap of lectures and quizzes at 12:15 – 13 • Prepare to present the correct answers for Ex3 at 13:15	• Watch the following lecture videos: - MOS capacitors - MOSFET I & II • Start preparing the exercise set 4 (Ex4) and quizzes 7-9
6	MOS and MOSFETs			Summary
	Exercise session 4 at 12:15 – 14 - Help available by TAs	• Submit lecture Quiz 7-9 (DL Wed at noon) • Finalise the exercise set 4	Recap of lectures and quizzes at 12:15 – 13 • Prepare to present the correct answers for Ex4 at 13:15	• Recap the course material and prepare yourself for the summary exercise and oral discussion
7	Summary			
	Group exercise 12:15 – 15 - Summary	• Recap the course material and prepare yourself for the oral discussion	Pair discussion exercise (15 min) - Time slots available between 8-17 (possibly on Friday too)	

Mondays: Short theory / help available by TAs related to the weekly exercises
Wednesdays: Quiz answers/discussion by teachers followed by demo exercises by the students

My Courses

https://mycourses.aalto.fi/course/view.php?id=20902

All material available there

- Lecture slides
- Book chapters
- Exercises and pre-lecture exercises and their return boxes
- News
- …

Return the exercises to MyCourses in pdf-format!

Post any questions primarily to the Discussion forum (can be found from the course front page). In personal issues (e.g. regarding the grading), you can contact the course assistants.

Home Page

Welcome to the ***Semiconductor Devices*** course in **Spring 2024**! Please do not miss the first lecture that will be held on **Monday 8.1. 2024 starting at 12:15** at Kide (Otakaari 2B) in lecture hall Skłodowska-Curie - 1501. In the course, we use recorded lecture videos together with on campus lecture recap and exercise sessions. After first week, **Mondays** are reserved for voluntary exercise help sessions (12:15-14:00). On **Wednesdays**, recap lecture takes place at 12:15-13:00 after which the "graded" Exercise session starts (more info in "Calculation Exercises" - MyCourses tab). All of these sessions are held at Kide (Otakaari 2B) in lecture hall Skłodowska-Curie - 1501.

How to get started?

- Video recordings for the course lectures are available online at the "Lecture Recordings" section for the whole duration of the course.
- You should start the course by participating to introduction lecture on Mon 8.1. at 12:15. During the first week, you should start watching the first recorded lectures. On Wed 10.1., we have the first guest lecture of the course given by Iiro Lehto from Okmetic, Inc.

Next lecture on WED

Semiconductor material aspects, focus on silicon

- **The actual lecture recording is available in MyCo.**
- **Let’s start here at 12:15**
  - Iiro Lehto from Okmetic
  - Q&A, lecture exercise discussion

Thank you!