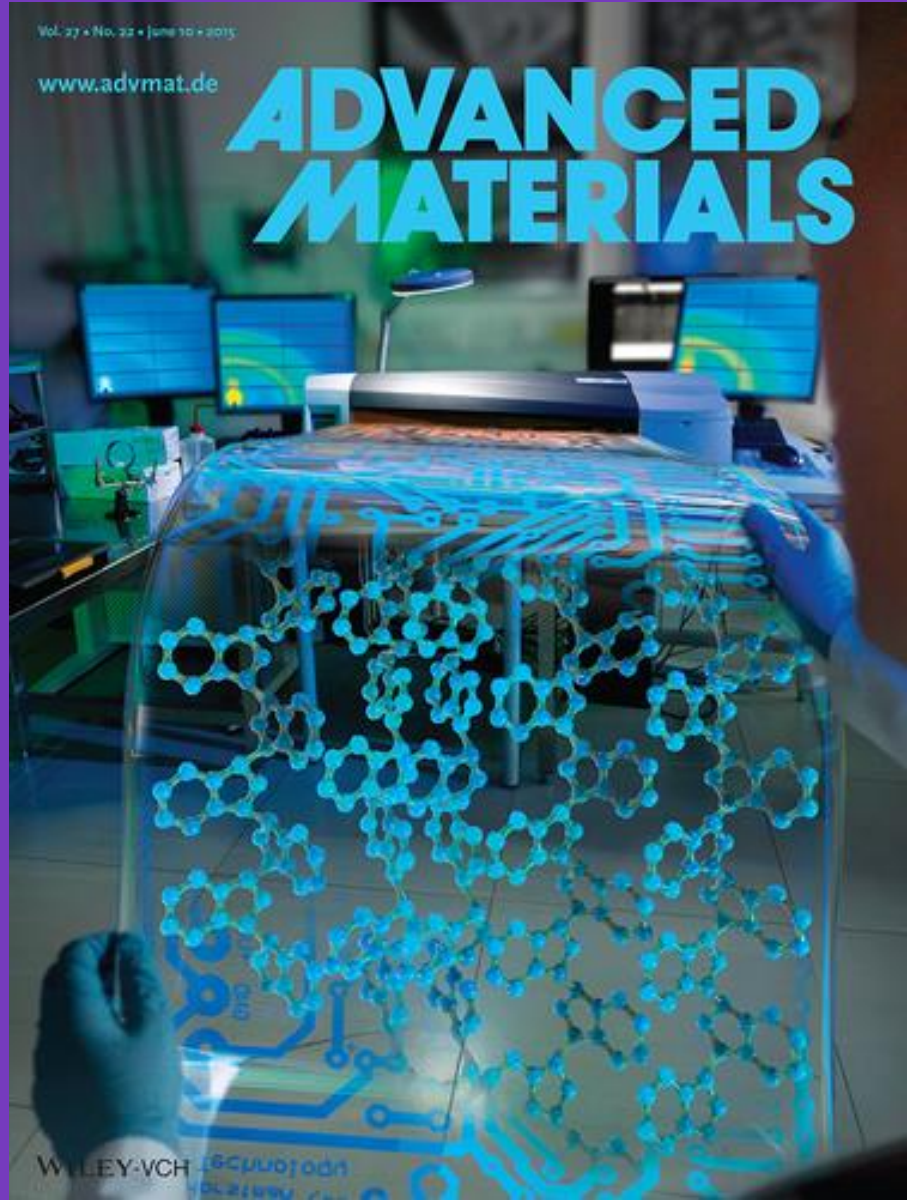
ELEC-E9210 Organic Electronics: Materials, Devices & Applications

Course Info - Fall 2023

Aalto University
School of Electrical
Engineering

https://organicelectronics.aalto.fi



ELEC-E9210: Learning Outcomes

By the end of this course:

• You will learn about structure and properties of organic materials and devices, their functioning and properties, and field of applications.

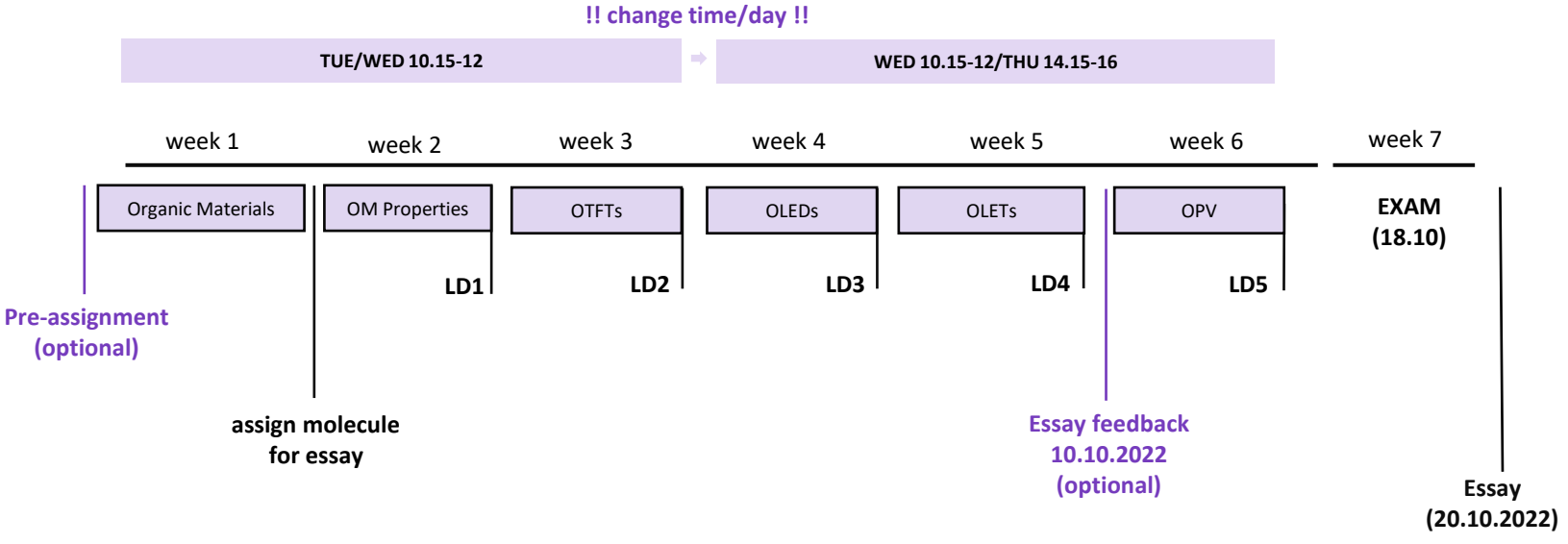
- Principle of organic materials (OMs)
- Properties of OMs, including electronic and optical properties
- Organic devices and working principles (*i.e.* transistors, diodes, sensors, solar cells)
- Applications of organic materials and devices

• You will be capable of critically reading and understanding a scientific text, extrapolating main ideas, summarizing your readings and findings.

• You will experience how to write a scientific document.

• You will be capable of delivering and assess clear scientific communication.

ELEC-E9210: (Tentative) Timeline & DLs



Information & instructions will be available on MC
All DLs are on Fridays, h18.00 (MyCourses)

ELEC-E9210: Description of Assignments

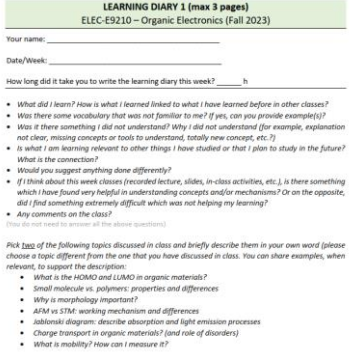
Learning Diary Each student will write a Learning Diary on a weekly basis (starting from week 2).
Each LD has two different sections:

Part 1 – COMPULSORY on specific reflections on the classes, topics and fundamental concepts of the week.

Part 2 – OPTIONAL to help you starting your essay. This will focus on the topic of the week, relevant to your molecule

Both part will receive feedback.

DL is ALWAYS on FRIDAYS, h18.00



LEARNING DIARY 1 (max 3 pages)
ELEC-E9210 – Organic Electronics (Fall 2023)

Your name: _____

Date/Week: _____

How long did it take you to write the learning diary this week? _____ h

- *What did I learn? How is what I learned linked to what I have learned before in other classes?*
- *Was there some vocabulary that was not familiar to me? If yes, can you provide example(s)?*
- *Was it there something I did not understand? Why I did not understand (for example, explanation not clear, missing concepts or tools to understand, totally new concept, etc.?)*
- *Is what I am learning relevant to other things I have studied or that I plan to study in the future? What is the connection?*
- *Would you suggest anything done differently?*
- *If I think about this week classes (recorded lecture, slides, in-class activities, etc.), is there something which I have found very helpful in understanding concepts and/or mechanisms? Or on the opposite, did I find something extremely difficult which was not helping my learning?*
- *Any comments on the class?*

(You do not need to answer all the above questions)

Pick <u>two</u> of the following topics discussed in class and briefly describe them in your own word (please choose a topic different from the one that you have discussed in class. You can share examples, when relevant, to support the description:

- *What is the HOMO and LUMO in organic materials?*
- *Small molecule vs. polymers: properties and differences*
- *Why is morphology important?*
- *AFM vs STM: working mechanism and differences*
- *Jablonski diagram: describe absorption and light emission processes*
- *Charge transport in organic materials? (and role of disorders)*
- *What is mobility? How can I measure it?*

STARTING YOUR ESSAY
ELEC-E9210 – Organic Electronics (Fall 2023)
Please note this is optional; this will serve as feedback for the final essay

How long did it take you to write this part? _____ h
Have you use any AI tool for this part?
If yes, please describe your query and cite it throughout the text.

"Your Molecule" and its structure

What is the structure of the molecule? Which properties does the structure confer to the molecule?
What are the values of HOMO and LUMO?
What are the main properties and role of this molecule? (OSC, host, guest, injection/blocking layer, light emitting or conductive polymers, etc.)

"Your Molecule" properties

Electrical properties
Does the molecule have specific electrical properties? (mobility, doping level, etc.)
Which is its use? (p- or n-transport, ambipolar material, host, guest, injection/blocking layer)
Is any study of mobility available? (function of temperature, thickness, growth parameters, etc.)

Optical properties
Does the molecule have specific optical properties? (UV absorption, TADF, luminescence in various forms such as crystals, thin-film or solution)

Morphology
How does this molecule packs? Is there a typical morphology for this molecule? (if yes, please share some images – STM/AFM/SEM or anything you can find)?
Does the molecule have *different packing scheme* leading to different properties? Is there a common morphology?

References
[1]
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ELEC-E9210: Description of Assignments

- **Essay** focuses on one organic molecule, which will be assigned during the first week of class (on Wednesday).
  If you are not present on Wednesday, you will be assigned one randomly.
  If you wish to choose your own molecule of interest, just send an email.

  Essay template and example (along with received feedback) from last Fall is available on MC.

  DL is on 20.10.23, h18.00

  DRAFT SUBMISSION: If you wish to receive feedback on your essay, please submit your draft. Draft can include preliminary text, list of ideas, general outline, full draft or what you have written so far. The more structured and organized is the draft, the more detailed can the feedback be.

  DL is h18.00 on 10.10.2022

- **Exam** We will have a discussion on some of the topics discussed during our lectures (slides/recording). The exam will mainly focus on theoretical concepts and aspects of organic materials, devices and applications. There will also be a question on your essay.

  EXAM is on 18.10.2022

ELEC-E9210: Workload

Assignment*	When	Workload	DL (ALWAYS h18.00)
Lectures	2/week	24h	
Learning Diary	Weekly (from wk2)	20h	**on Fridays (from wk2)**
Essay Draft	-	-	**10.10**
Essay	-	40h	**20.10**
Final Exam	-	40h	**18.10**
	Total	**124h**	

*Please report how much time you have spent on preparing each assignment. This will help me assessing the real workload. Thanks!

ELEC-E9210: Grading

Assignment	Points (max)
Learning Diary	20 (4/each)
Essay	40
Exam	40
Total	**100**
Extra point	
Pre-assignment	2
Longer exam*	10
Paper presentation*	10

* needs to be agreed with Caterina in advanced

Final grade scale:

- <50 = FAIL
- 50-60 = grade **1**
- 61-71 = grade **2**
- 72-81 = grade **3**
- 82-92 = grade **4**
- ≥ 93 = grade **5**

EXTRA POINTS (on request/upon agreement)

- (Longer) Oral Exam (+20 minutes). Max 10 points.
- Paper presentation on one relevant topic from class. Max 10 points.

ELEC-E9210 Resources

Recorded Lectures will be published on MyCourses on Friday, previous week. Lectures focus both on theoretical aspects as well as applications. Lecture material is expected to be studied prior to that week classes (week topic).

Slides (will be uploaded on MC before the class, so you can take notes during sessions)

- many slides contain reference to peer-reviewed scientific papers. All materials is referenced so you can retrieve the paper if looking forward for more detailed readings.

Books

- *Organic Field Effect Transistors - Theory, Fabrication and Characterization* I. Kysmissis, Springer (2009)
- *Physics of Organic Semiconductors* Wiley-VCH, edited by W. Brütting (2005)
- *Organic Electronics, Materials, Processing, Devices and Applications* ed. by F. So, CRC Press (2010)

ELEC-E9210 Resources

Online forum on MyCourses, where it is possible to discuss about lectures, curiosity come up during class (and for which we did not have time to discuss about it) or things that you would like to know more details about. Don´t be shy and enjoy a lively discussion.

If you wish to receive additional resources on some specific topics, just let me know.

- **ELEC-E9210 MyCourses space** if you encounter any problem when submitting materials, or incorrect information on MyCourses, please let me know ASAP.
- Presence in not mandatory for this course.
- About using AI resources in Teaching & Learning at Aalto University