

COURSE SYLLABUS AND COURSE REQUIREMENTS

ACADEMIC YEAR 2023/2024 SEMESTER 2

<i>Course title</i>	Microelectronics
<i>Course Code</i>	IVB273ANVM
<i>Hours/Week: le/pr/lab</i>	2 / 0 / 0
<i>Credits</i>	3
<i>Degree Programme</i>	BSc
<i>Study Mode</i>	
<i>Requirements</i>	mid-term
<i>Teaching Period</i>	Spring
<i>Prerequisites</i>	none
<i>Department(s)</i>	Department of Electrical Networks
<i>Course Director</i>	Kisander Zsolt
<i>Teaching Staff</i>	Dr. Molnár László Milán assistant professor

COURSE DESCRIPTION

A short description of the course (max. 10 sentences).

Neptun: [Instruction/Subjects/Subject Details/Basic data/Subject description](#)

The course is designed to connect the already known materials science knowledge of semiconductors to device-level working principles and their application in very-high scale integrated circuits and amplifiers.

SYLLABUS

Neptun: [Instruction/Subjects/Subject Details/Syllabus](#)

1. GOALS AND OBJECTIVES

Goals, student learning outcome.

Neptun: [Instruction/Subjects/Subject Details/Syllabus/Goal of Instruction](#)

Electronic materials, especially focusing on semiconductors (intrinsic: Si, Ge; compound: III-V semiconductors). Transport processes in semiconductors – simplified quantum mechanics model, density of states; electron and hole transport. Working principle of p-n junction derived from transport processes. Characteristics of diodes, calculation methods (including approximation models). Field-effect transistors – working principle, types, structure; FET characteristics (parameters of FETs) and basic calculations of FET-based circuits (esp. common source). Realization of an inverter with FET. Bipolar transistors, characteristics, working modes. Early-effect, and other non-ideal effects. Common-emitter setup, load line, voltage transfer characteristics. Inverters, amplifiers and logical gates. Scaling problems of integrated circuits, manufacturing of devices. Introduction to optoelectronics; light-emitting devices.

2. COURSE CONTENT

Neptun: [Instruction/Subjects/Subject Details/Syllabus/Subject content](#)

TOPICS

LECTURE	TOPICS
	1.- 2.: semiconductor physics considerations
	3.-6.: basic devices: diodes, transistors
	7.-10.: circuits and their manufacturing

DETAILED SYLLABUS AND COURSE SCHEDULE

ACADEMIC HOLIDAYS INCLUDED

LECTURE

week	Topic	Compulsory reading; page number (from ... to ...)	Required tasks (assignments, tests, etc.)	Completion date, due date
1.	Introduction of microelectronics.	[1.] Sze Section 1.3. – 1.4.		2024.02.05.
2.	Electrical conduction in solids, semiconductors, p-n junction	[1.] Sze Section 1.3. – 1.4. [2.] Neamen Section 1.1.1.-1.1.2 [2.] Neamen Section 1.1.3.		2024.02.12.
3.	P-n junction, diodes	[3.] Majumder et al. Section 1.2. [2.] Neamen Section 1.2.-1.5		2024.02.19.
4.	FETs	[2.] Neamen Chapter 3		2024.02.26.
5.	MOSFETs	[2.] Neamen Chapter 3		2024.03.04.
6.	Bipolar transistors, basic circuits	[2.] Neamen Chapter 5		2024.03.11.
7.	Mid-term test			2024.03.18.
8.	Analog circuits	[2.] Neamen Part 2; Chapter 9, 12, 13		2024.03.25.
9.	Spring holiday (no lecture)			2024.04.01.
10.	VLSI scaling	[3.] Majumder Chapter 7		2024.04.08.
11.	VLSI manufacturing			2023.04.15.
12.	Optoelectronic Devices			2023.04.22.
13.	Mid-term test			2023.04.29.
14.	Supplementary mid-term			2023.05.06.

3. ASSESSMENT AND EVALUATION

(Neptun: Instruction/Subjects/Subject Details/Syllabus/Examination and Evaluation System)

ATTENDANCE

In accordance with the Code of Studies and Examinations of the University of Pécs, Article 45 (2) and Annex 9. (Article 3) a student may be refused a grade or qualification in the given full-time course if the number of class absences exceeds 30% of the contact hours stipulated in the course description.

Method for monitoring attendance (e.g.: attendance sheet / online test/ register, etc.)

None

ASSESSMENT

Cells of the appropriate type of requirement is to be filled out (course-units resulting in mid-term grade or examination). Cells of the other type can be deleted.

Course resulting in mid-term grade (PTE TVSz 40§(3))

Mid-term assessments, performance evaluation and their ratio in the final grade (The samples in the table to be deleted.)

Type	Assessment	Ratio in the final grade
Mid-term test 1	max. 60 points	60%
Mid-term test 2	max 40 points	40%

Opportunity and procedure for re-takes (PTE TVSz 47§(4))

The specific regulations for improving grades and resitting tests must be read and applied according to the general Code of Studies and Examinations. E.g.: all tests and assessment tasks can be repeated/improved at least once every semester, and the tests and home assignments can be repeated/improved at least once in the first two weeks of the examination period.

All tests can be repeated during the last lecture in the semester. In case of re-take, result of first try will be neglected in final grade.

Grade calculation as a percentage

based on the aggregate performance according to the following table

Course grade	Performance in %
excellent (5)	85 % ...
good (4)	70 % ... 85 %
satisfactory (3)	55 % ... 70 %
pass (2)	40 % ... 55 %
fail (1)	below 40 %

The lower limit given at each grade belongs to that grade.

4. SPECIFIED LITERATURE

In order of relevance. (In Neptun ES: Instruction/Subject/Subject details/Syllabus/Literature)

COMPULSORY READING AND AVAILABILITY

[1.] S.M: Sze, M.K. Lee: Semiconductor Devices – Physics and Technology ISBN 978-0470-53794-7

[2.] Donald A. Neamen: Microelectronics: Circuit Analysis and Design ISBN 978-0-07-338064-3

[3.] M.K. Majumder et al: Introduction to Microelectronics to Nanoelectronics – Design and Technology ISBN: 9781003049203 (ebk)