Institute of Cyber-physical Systems			2023/24/1 semester			
Name of the subject:	Code of the subject:	Credits:	Weekly hours:			
				lec	sem	lab
Digital Systems	NIXDR0EBNE	4	full-time	2	0	2
Responsible person for the subject: Dr. Komoróczki – Steiner Henriette			Classification:			
Subject lecturer(s): Mehdi Taassori						
Prerequisites:						
Way of the assessment:	Mid term exam					

Course description	
Goal:	The aim of the course is to familiarize students with the basic knowledge of digital electronics required for a technical computer scientist, the most important building blocks of digital systems, the development trends of logic families, the application issues of logic families and the building blocks that can be used for the programmed implementation of complex functions. In the course of the course, students will learn about the theoretical operation of digital systems (logic networks), the basic methods of their description, the operation of logic networks through examples, insights into the design of logic networks, and computer simulation methods through problem solving and demonstrations. The objective of the course is to familiarise students with the basic knowledge of digital electronics required for the computer engineer, the most important building blocks of digital systems, the development trends of logic families, the application issues of logic families and the building blocks that can be used for the programmed implementation of complex functions
Course description:	After the concept of logic circuits and their theoretical operation, the basic types of logic circuits and their description options are discussed. After the basics of Boolean algebra, the universal logic functions and the building blocks that implement them are introduced. The student will then be able to design and study combinatorial networks. To do this, they will learn the basics of systematic design methods, the basic tools and the most important methods of analysis. They will be aware of the characteristics of ideal and real building blocks and the difference between them. The introduction to the basic types of serial networks will include a discussion of their description methods and building blocks. Then the design and study of asynchronous networks: the student will be asked to design and simulate single and multi-output logic circuits using electronic CAD software, and to design, implement, test and document complex digital circuits using FPGA circuits. Other tasks include the generation of downloadable files, online downloading, testing, debugging, debugging, documentation.

Lecture schedule	
Education week	Topic
1.	Basics of Boolean algebra
2.	Description methods for combinatorial networks
3.	Ideal and real building blocks, characteristics of real building blocks
4.	Sequence networks
5.	Design and analysis of synchronous networks
6.	Typical synchronous networks
7.	Application of logic families: the diode
8.	General characteristics of logic circuits: the transistor
9.	The finite state machine: elements of the CPU
10.	The finite state machine: steps to implement a CPU
11.	Computer-aided design simulation, CAD operation and mathematical principles

12.	Complex application tasks and related computational tasks and completion of the online test
13.	Laboratory large ZH and Theoretical large ZH
14.	Substitution: laboratory large ZH, theoretical large ZH

Mid-term requirements	
Conditions for obtaining a mid-term grade/signature	The subject consists of weekly lessons in the framework of E-learning. In the case of the theoretical material, each week contains 1-4 sub-headings per lesson in the form of videos and published notes. After these units, students can use a short self-assessment test, which can be completed in any number of units. This division aims to enable students to progress through one lesson each day in small units. There are more extended self-assessment tests and a written version of the theoretical material at the end of the week. The written material also includes additional review theory questions and exercises, which will be asked to be solved orally and in writing. Each week the exercises will be accompanied by theoretical and practical material and a video related to the given course material, measurement or simulation task. A set of related self-checking questions also follows them. For students to complete the exercise assignment, they should arrive at each exercise prepared from the theoretical and practical material covered so far, and they should also be familiar with the assigned theoretical and valuable part of the exercise material. This knowledge is important, so there will be tested each time in a small exam. All the activities must be completed in the laboratory exercise, and all the worksheets must be submitted in full. Students must prepare for the laboratory exercises according to the instructions provided. Otherwise, they will not be allowed to participate in the laboratory exercise, which will be considered an unexcused absence. During the first 12 weeks, each student must prepare a written (handwritten) assignment sheet (a record) of the given class assignments, and the completed assignment sheet must be submitted and uploaded to Moodle. The Assignment Sheets should include the following: formulation of the measurement task, required wiring diagrams, measurement/simulation plan, exact calculation procedure, measurement/calculation/simulation results and finally, the evaluation of the measurement/calculation results. A student absent from more than 30% of the laboratory sessions (TVSZ) will exclude from the course. During the semester, the students will answer some questions based on the small practical tests, the online test, and the theoretical and practical extensive tests. Small exams: During the semester, the students take several small exams well written. The small exams will be written by all students simultaneously, either during the theory class or the practical course. Unwritten exams will be counted with 0% of the grade. During the semester, one small exam can be made up once (week 11). If the average of the small exams, including the makeup, does not reach 60%, the student has to take a signature makeup examination at the time scheduled during the examination period. IMPORTANT: the small practical exam includes the theoretical and empirical material covered in the previous lessons and the material covered in the current lesson!

	Online test During the semester, in week 12, there will be a 50 questions-test a will be completed on Moodle. The test can be completed two times, and a better result will be considered. If the test score is less than 80%, the student is not eligible to take the major exam and must take a substitute exam. Lab major final exam: The students will write the final lab exam in the 13th week of the lab practical. Here, the student has to solve a laboratory problem independently based on what has been learned during the semester. If the result of this or the makeup exam is below 60%, the student has to take a signature makeup exam at the time of the exam (the impact of the last written exam counts). Presentation of a major final examination: In week 13, the students will write the final lecture exam during the theory or lab class, which can be corrected once during the semester in week 13 (regardless of the student's lab assignment). If the result of this or the correction does not reach 60%, the students have to take a signature makeup exam at the time of the exam (the impact of the last written exam counts). To obtain a mark, the cumulative result of the small exams written in the practical, the result of the final practical exam, and the result of the final theoretical exam, individually, must be at least satisfactory, i.e. separately, it must reach 60%, and the development of the online test must get 80%, and the cumulative laboratory performance (all laboratory tasks must be complete in written form) must be acceptable.

Assessment schedule

Education week	Topic
12	online test
13	midterm theoretical and laboratory exam (ZH)

Method used to calculate the *mid-term grade* (to be filled out only for subjects with mid-term grades)

Completion of online test (min 80% score required) - The test can be taken twice.

Small exam makeup

Lab final exam and Theoretical final exam

Substitution.

Method for determining the end-of-semester grade (E)

All rates (small exams, large (final) exams, online tests) will be expressed as a percentage.

Method of calculating the grade (if all other conditions):

MARK= (Lab major exam % + Theoretical major exam %) / 2 [%]

(each of the two exams separately must reach 60%)

Type of the replacement	
Type of the replacement of written test/mid-term grade/signature	The students can make up one small exam during the semester in week 11. The two final exams (the final laboratory exam and the final theoretical exam) are required to obtain the mid-term grade. The students can make up in week 14. All parts must be made up in the signature makeup examination: - Presentation of the completed worksheets (from week 1 to week 12). - Small exam questions - Lab final exam - Theoretical final Examination method The subject ends with a mid-year mark. The small exams will be written before the practical class, in the theory class, in the experimental style or the context of homework. The test is written in week 12 online: on Moodle. The final theoretical exam has written in week 13. The final practical exam written in week 13 is a complex measurement or simulation task development during suitable week 13.

Type of the exam (to be filled out only for subjects with exams)

Calculation of the exam mark (to be filled only for subjects with exams)

Final grade calculation methods:

All rates (small exams, large (final) exams, online tests) will be expressed as a percentage.

Method of calculating the grade (if all other conditions):

MARK= (Lab major exam % + Theoretical major exam %) / 2 [%]
(each of the two exams separately must reach 60%)

Point thresholds for each merit grade:
0% - 59%: unsatisfactory (1)
60% - 69%: satisfactory (2)
70% - 79%: average (3)
80% - 89%: good (4)
90% - 100%: excellent (5)

References	
Obligatory:	**MOODLE**
Recommended:	Ronald Tocci , Neal Widmer , Gregory Moss: Digital systems Pearson Education 2017 Floyd, Thomas L: Digital Fundamentals Pearson Education 2021 Axelevitch Alexander: Digital Electronic Circuits - The Comprehensive ViewWorld Scientific Pub Co Inc 2018
Other references:	