Institute of Cyber-Physical Systems						
Name of the subject:	Code of the subject:	Credits:	Weekly hours:			
				lec	sem	lab
Electronics	NKXEL1EBNF	5	full-time	2	0	2
Responsible person for the subject: Dr. Mehdi Taassori			Classification:			
Subject lecturer(s):						
Prerequisites:	NKXEAIEBNF	Electronics Basic				
Way of the assessment:	mid-term grade					

Course description	
Goal:	The capability to use abstractions to analyze and design simple electronic circuits.
Course description:	Learn how to develop and employ circuit models for elementary electronic components, e.g. diodes and transistors. Develop the capability to analyze and design simple circuits containing electronic components.

Lecture schedule	
Education week	Topic
1.	Signals and Amplifiers, Frequency Spectrum of Signals, Analog and Digital Signals, Amplifiers, Circuit Models for Amplifiers, Frequency Response of Amplifiers
2.	Semiconductors, Bohr Model for an Atom, Bohr Model of the Silicon Atom Energy Diagram, Semiconductor Atom & Conductor Atom, Silicon & Germanium, Covalent Bonds in Silicon, Covalent Bonds, Conductivity of Semiconductor , Electron Current , Hole Current , Silicon Crystal, N Type Semiconductor, P Type Semiconductor, PN Junction, Depletion Region, Energy Diagram, PN Junction with No Applied Voltage, PN Junction with an Applied Voltage, Current Voltage Relationship of the Junction , I-V Characteristic
3.	Diodes, The Ideal Diode, Terminal Characteristics of Junction Diodes, Modeling the Diode Forward Characteristic
4.	Operation in the Reverse Breakdown Region — Zener Diodes, Rectifier Circuits, Limiting and Clamping Circuits
5.	Bipolar Junction Transistors (BJT), Device Structure and Physical Operation, Current–Voltage Characteristics, BJT Circuits at DC, Configurations of BJT Amplifiers , Transistor as a Switch, Logic Families
6.	Operational Amplifiers, The Ideal Op Amp, The Inverting Configuration
7.	The Noninverting Configuration, Difference Amplifiers, Integrators and Differentiators
8.	DC Imperfections, Effect of Finite Open-Loop Gain and Bandwidth on Circuit Performance
9.	MOS Field-Effect Transistors (MOSFETs), Device Structure and Physical Operation, Current–Voltage Characteristics, MOSFET Circuits at DC
10.	Basic Configurations of MOSFET Amplifiers, MOSFET Transistor as a switch, Digital Logic Inverter
11.	CMOS Digital Logic Circuits
12.	CMOS Digital Logic Circuits
13.	Theoretical Exam – Lab Exam
14.	Retake Theoretical Exam – Retake Lab Exam

Mid-term requirements	
Conditions for obtaining a mid-term grade/signature	Written exam, , Lab exam, Quizzes, Homeworks

Assessment schedule	
Education week	Topic
12	In the lab hour : Lab Exam
13	Theoretical Exam – Retake Lab Exam
14	Retake Theoretical Exam – Retake Lab Exam

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

- Homework 10%
- Quiz 0 - 10%
- Lab 15%
- Exam 65% - 75%

Type of the replacement	
Type of the replacement of written test/mid-term grade/signature	Retake exam: once in the first 10 working days of the examination period.

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)

- Homework 10%
- Quiz 0 - 10%
- Lab 15%
- Exam 65% - 75%
- The submission of homework and project by the designated deadline is mandatory for all students.
- Attendance for lab sessions, lab exam, quizzes, and the exam is mandatory.
- Conducting the quiz and delivering the project depends on the class schedule.
- A minimum of 51% must be achieved in each exam to pass.

Final grade calculation methods:

0-59 points - Fail
60-69 points - Pass
70-79 points – Satisfactory
80-89 points - Good
90-100 points - Excellent

References	
Obligatory:	Sedra, Adel S., and Kenneth C. Smith. "Microelectronic circuits seventh edition." (2015)
Recommended:	
Other references:	