

Óbuda University Kandó Kálmán Faculty of Electrical Engineering		Institute of Microelectronics and Technology		
<i>Subject name and code</i>		Elektronika KMEEA13TEC,		
Full-time, Spring Semester,		Credits: 4		
Course: Mechatronics engineering (English language course)				
Responsible:	Dr. Turmezei Péter PhD	Teaching staff::	Horváth Márk	
Prerequisites:		Electrical Engineering I		
Contact hours per week:	Lecture: 2	Class discussion: 1	Lab hours: 1	Tutorial: 0
Assessment and evaluation:	Written exam			
Subject description				
<u>Goal:</u> The subject's aim is to understand the basic properties and applications of basic semiconductor devices and circuits such as diodes, transistors and operational amplifiers.				
<u>Topics:</u> Electric current in semiconductors, p-n junction, diodes. Bipolar transistors. Field-effect transistors. Amplifier circuits. Frequency dependence of transistor circuits. Differential amplifiers. Operational amplifiers, comparators.				
<i>Topics of lecture:</i>			Week	Lessons
1 Semiconductors. Intrinsic and doped semiconductors, n and p type crystal structures. Majority and minority charge carriers. Conductivity in semiconductors, drift and diffusion current. p-n junction, space charge region, diffusion potential. Behaviour of p-n junction due to external bias.			1.	2
2 Application of semiconductor diodes. The semiconductor diode. Thermal dependence and capacity of p-n junction. Concept of operating point, static and dynamic resistance.			2.	2
3 Bipolar transistor. Structure, properties, characteristics and function of bipolar transistors. Setting of operating point, thermal dependence.			3.	2
4 Basic concepts of amplification. Basic concepts of amplifying analogue signals. Symmetrical and asymmetrical voltages of amplifiers. Substitute circuits and frequency dependence. Bode diagrams of DC and AC amplifiers.			4.	2
5 Amplification with bipolar transistor. Physical process of amplification. CE, CC, CB basic circuits. Parameters of amplifiers.			5	2
6 Frequency dependence of transistor amplifiers. Analysis of frequency dependence of bipolar transistor amplifiers. Impact of series and emitter capacitors.			6	2
7 MOS-FET. Structure and operation of MOS-FETs. Enhancement and depletion MOS-FET. Characteristics. CMOS circuits.			7	2

8 J-FET. Structure and operation of J-FET. Characteristics. Setting of operating point; thermal dependance. Basic circuits.	8	2
9 Feedback. Feedback of amplifiers. Basic types of feedback and their impact on parameters.	9	2
10 Frequency dependence of feedback amplifiers Effect of feedback of frequency dependence. Stability and frequency compensation.	10	2
11 Differential amplifier, operational amplifier Differential amplifier circuits, operation and parameter; symmetrical and common mode signals. Operational amplifiers.	11	2
12. Applications of operational amplifiers. Mathematical operations (summing, subtracting, differentiating and integrating circuits). Current-voltage transformer. AC amplifiers. Basic voltage and current sources. Nonlinear applications. Precision rectifiers.	12	2
13.Comparators. Null-comparator, reference voltage comparators, hysteresis comparators (Schmitt-triggers). Waveform generators.	13	2
break	14	2
Topics of classroom practice		
Diode data sheet, diode circuits.	1	2
Bipolar transistor data sheet, circuits DC calculation.	2	2
Bipolar amplifier AC calculation	3	2
JFET, MOSFET data sheet, DC and AC calculation	4	2
Differential amplifiers, other transistor circuits	5	2
Operational amplifiers data sheet, basic circuits	6	2
Comparators and other opamp circuits	7	2
Topics of laboratory		
Computer simulation: Getting to know simulation software. Diode circuits. Homework assignment.	1	2
Measurement: Diode characteristics, rectifier circuits.	2	3
Measurement: Bipolar transistor characteristics, current generator, amplifiers.	3	3
Measurement: JFET/MOSFET characteristics, current generator, amplifiers.	4	3
Measurement: Operational amplifier circuits	5	3
Assessment and evaluation		
The attendance of lectures is mandatory. Participation in exam is available after receiving signature from subject Electronics I. practice (KMEEL12ANC).		
<u>Requirements of the signature:</u> Short tests in the practice course and laboratory reports have to be accepted in order to get the signature.		
<u>Type of exam:</u> Written exam. Exam is taken from the material of the theory and practice courses, in writing and possibly orally as well. There are short theoretical questions, long theoretical questions and calculation exercises.		

Suggested material