Subject (course) name: **Introduction to Electronics**		
Field of study: **Electronics and Communications** Specialty: **all**		Subject code: **2K** Title graduate: **Engineer**
Type of course: **major course, obligatory**	Course level: **First-cycle studies**	Year: **II** Semester: **III** Semester: **autumn**
Form of classes: **Lectures, Classes, Labs, Seminar, Project**	Number of hours per week: **1L, 1, 2Lab, 0, 0**	Credit points: **5 ECTS**

GUIDE TO SUBJECT

SUBJECT OBJECTIVES

C1. General knowledge of basic semiconductor devices.

C2. Techniques of analysis and design of elementary analog circuits.

C3. Practical skills in measurement of semiconductor devices and elementary analog circuits.

SUBJECT REQUIREMENTS

1. Math fundamentals.
2. Basic knowledge of circuit theory.
3. General ability of individual and group work
4. General ability to search in literature

LERNING OUTCOMES

EK 1 - Student will be able to classify basic semiconductor devices and explain their principle of operation.

EK 2 - Student will be able to conduct an analysis of elementary analog circuits and formulate simple conclusions.

EK3 - Student will be able to design simple analog circuits.

EK4 - Student will be able to conduct the measurements of the basic parameters of analog circuits and process the measurement data.

SUBJECT CONTENT

Form of classes - lectures

Topic	Hours
W1 – Semiconductor diode – large signal characteristics	**1**
W2 – Dynamic resistance and a small signal model of a diode	**1**
W3 – Basic applications of diodes	**1**
W4 – Bipolar transistor, I-V characteristics and large-signal models	**1**
W5 – Small-signal model of a bipolar transistor	**1**
W6 – Transistor as a switch	**1**
W7 – Elementary amplifiers-part I	**1**
W8 – Elementary amplifiers-part II	**1**
W9 – Transistor MOS, I-V characteristics and large-signal models	**1**
W10 – Small-signal model of a MOS transistor	**1**
W11 – MOS transistor as a switch	**1**
W12 – Elementary amplifiers based on a MOS transistor	**1**

W13 – Operational amplifier-basic characteristics	**1**
W14 – Basic applications of an operational amplifier – part I	**1**
W15 – Basic applications of an operational amplifier – part II	**1**
Total	**15**

Form of classes – exercise classes

Topic	Hours
C1 – Large-signal applications of semiconductor diodes	**1**
C2 – Small-signal applications of semiconductor diodes	**1**
C3 – I-V characteristics of a bipolar transistor	**1**
C4 – DC operating point of a transistor amplifier	**1**
C5 – Transistor amplifiers – part I	**1**
C6 – Transistor amplifiers – part II	**1**
C7 – Transistor as a switch	**1**
C8 – Test no. 1	**1**
C9 – I-V characteristics of a MOS transistor	**1**
C10 – Transistor amplifiers (MOS) – part I	**1**
C11 – Transistor amplifiers (MOS)– part I	**1**
C12 – Linear applications of an operational amplifier – part I	**1**
C13 – Linear applications of an operational amplifier – part II	**1**
C14 – Nonlinear applications on an operational amplifier	**1**
C15– Test no. 2	**1**
Total	**15**

Form of classes – laboratory

Topic	Hours
L0 – Introduction	**2**
L1 – Semiconductor diodes	**2**
L2 – Small-signal amplifier	**2**
L3 – Operational amplifier	**2**
L4 – First-order low-pass and high-pass filters	**2**
L5 – Multivibrators	**2**
L6 – Voltage regulators	**2**
L7 – Zener diodes	**2**
L8 – Operating point of a bipolar transistor	**2**
L9 – Schmitt trigger	**2**
L10 – Active filters	**2**
L11 – Nonsinusoidal oscillators	**2**
L12 – Switching regulators	**2**
L13 – Spare term	**2**
L14– Final assessment	**2**
Total	**30**

STUDY METHODS

1. Lectures
2. Exercises – analysis and design of electronic circuits
3. Laboratory – measurement of electronic circuits – teamwork

EDUCATIONAL TOOLS

1. Textbook with exercises for individual practice
2. Laboratory instructions
3. Measurement equipment

METHODS OF ASSESMENT (F – Forming, P – Summary)

F1. assessment of laboratory reports
F2. two tests during the course of study
P1. lecture – exam
P2. exercise classes – average result from two tests during the course of study
P3. laboratory – average result from all laboratory reports during the course of study

STUDENT WORKLOAD

Form of activity	Averaged workload (hours)		
	[h]	∑ [h]	ECTS
Participation in class activities lecture exercise classes laboratory individual consultations	15 15 30 5	65	3
Preparation for tutorials (reading literature)	6	60	2
Preparation for lab classes	12		
Preparation of lab reports	12		
Preparation for tests (exercise classes)	12		
Preparation for final exam	18		
Total		**125**	**5**

A. BASIC READING

1. T.F. Floyd, D.M. Buchla, "Electronics fundamentals", 8-th ed. Prentice Hall, 2009

2. T.F. Floyd, "Electronic devices: electron flow version", 9-th ed. Prentice Hall, 2012

B. FURTHER READING

1. Tietze U. Schenk Ch. Electronic Circuits –Handbook for Design and Application, 2-nd ed. 2008

2. Various catalogues and application notes from components manufacturers

Learning objectives	In relation to the learning outcomes specified for the field of study	Subject objectives	Study methods	Methods of assessment
EK1	K_W13 K_U07 K_U09 K_U15	C1, C2	lecture	P1
EK2	K_W13 K_U07 K_U09 K_U15	C2	Exercise classes	F2,P2
EK3	K_W13 K_U07 K_U09 K_U15	C1,C2	Lecture, exercise classes	F2,P2
EK4	K_W13	C1,C3	laboratory	F1, P3

II. EVALUATION

Grade	Outcome
EK1	**Student is able to classify and explain the principle of operation of basic semiconductor devices**
2 (F)	Student is not able to draw I-V characteristics of a device, nor explain its principle of operation
3 (E)	Student is able to draw I-V characterictics of a device and roughly explain its principle of operation
4 (C)	Student is able to draw I-V characteristics of a device and explain its principle of operation giving basic characteristics and formulas
5 (A)	Student is able to draw I-V characteristics of a device and explain its principle of operation giving basic characteristics and formulas. Student has a knowledge of second-order effects and possible applications the device
EK2	**Student is able to analyse the operation of basic analog circuits and formulate basic conclusions**
2 (F)	Student grade for solving a set of exercises is lower than 50%
3 (E)	Student grade for solving a set of exercises is equal to 50%
4 (C)	Student grade for solving a set of exercises is equal to 70%
5 (A)	Student grade for solving a set of exercises is equal to 90%
EK3	**Student is able to design simple and typical electronic circuits**
2 (F)	Student grade for solving a set of exercises is lower than 50%
3 (E)	Student grade for solving a set of exercises is equal to 50%
4 (C)	Student grade for solving a set of exercises is equal to 70%

5 (A)	Student grade for solving a set of exercises is equal to 90%
EK4	**Student is able to design the measurements of the basic parameters of analog circuits and process the measurement data**
2 (F)	Student is not able to conduct the correct measurements and calculations
3 (E)	Student is able to present at least 50% of correct measurements and calculations
4 (C)	Student is able to present at least 80% of correct measurements, calculations and correct conclusions
5 (A)	S Student is able to present at least 95% of correct measurements, calculations and correct conclusions

III. OTHER USEFUL INFORMATION

1. All information for students on the schedule are available on the notice board and on the website: https://we.pcz.pl/
2. Information on the consultation shall be provided to students during the first lecture and will be placed on the website https://we.pcz.pl/
3. Terms and conditions of credit courses will be provided to students during the first lecture