Faculty of Electronics (W4) / Department of Field Theory, Electronic Circuits and Optoelectronics (K35W04D02)

SUBJECT CARD

Name of subject in Polish: **Układy elektroniczne**
Name of subject in English: **Electronic Circuits**
Main field of study (if applicable): **Electronic and Computer Engineering (ECE)**
Profile: **academic**
Level and form of studies: **1st level, full-time**
Kind of subject: **obligatory**
Subject code: **ECEA20009**
Group of courses: **Yes**

	Lecture	Exercise	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		30	30	
Number of hours of total student workload (CNPS)	90		90	60	
Form of crediting	Examination		Crediting with grade	Crediting with grade	
For group of courses mark (X) the final course	X				
Number of ECTS points	8.0				
including number of ECTS points for practical (P) classes			3.0	2.0	
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	1.0		2.0	1.0	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Circuit theory at the intermediate level

SUBJECT OBJECTIVES

C1. Earning the knowledge in construction, way of operation and properties of basic electronic circuits as well as trends in development of them.

C2. Getting ability in design of elementary electronic circuits

C3. Familiarize with SPICE-like systems for electronic circuits analysis

C4. Acquiring the ability to assemble and run simple electronic systems

C5. Gaining skills in measurements basic parameters of electronic system using multimeter, scope, function generator

C6. Doskonalenie umiejętności sporządzenia opisu przeprowadzonych eksperymentów w przejrzystej formie

SUBJECT LEARNING OUTCOMES
Relating to knowledge: PEU_W01 - The student explains the construction and principle of operation of basic electronic circuits; The student describes the basic techniques of analysis and design of electronic circuits (including computer-aided design techniques); The student knows the development trends of analog electronic systems, including integrated circuits Relating to skills: PEU_U01 - The student is able, in accordance with the given specification and using appropriate methods, techniques and tools (including computer simulations), to design a simple electronic system; PEU_U02 - The student is able to implement a simple electronic circuit, run it and measure its basic parameters and collect the results of the experiment in the form of a report.

PROGRAM CONTENT		
Lecture		**Number of hours**
Lec1	Electronic amplifiers parameters	2
Lec2-4	BJT, FET, MOSFET transistor amplifier (Q-point/small signal model/ pulse amplifier/wideband amplifier/ power amplifier	6
Lec5-8	Differential amplifier; Operational amplifier and its applications (inverting and non-inverting amplifier / integrator and differentiator / filters / non-linear applications / comparators)	8
Lec9	AD and DA converters.	2
Lec10	Sine wave oscillators and flip-flops.	2
Lec11-13	Power supply circuits; voltage and current regulators; DC-DC converters	6
Lec14	PLL and applications; synchronous detection.	2
Lec15	Summary, overview	2
	Total hours:	30

Laboratory		Number of hours
Lab1	Introduction: - familiarizing students with the rules of work safety in the laboratory; -to familiarize students with the operation of the apparatus	3
Lab2-10	The student performs eight measurement experiments from the list of topics available in the Laboratory of Electronic Systems: 1. Operational amplifier – basic configurations; 2. Operational amplifier – differentiator, integrator 3. Operational amplifier – active filter; 4. Instrumentation amplifier; 5. Transistor amplifier – CE configuration; 6. Transistor as a switch; 7. Rectifier with capacitive filtering; 8. Linear voltage regulator; 9. DC-DC converter – up converter; 10. DC-DC converter – down converter; 11. DC-DC converter – inverter; 12. DC-DC converter – (by WURTH); 13. Power amplifier; 14. Kristal generator (SMD); 15. Astable flip-flop- 555; 16. Monostable flip-flop – 555; 17. Self-constructed DCPM motor; 18. Pressure sensor with microcontroller (advanced); 19. PLL – frequency synthesizer (advanced); 20. Light sources parameters (advanced); 21. LED parameters (advanced); 22. Relay actuator – (electromechanical relay and SSR) –(advanced); 23. Stepper motor medium power (advanced);	27
	Total hours:	30

Project		Number of hours
Pr1-3	Operational amplifier – calculations and computer analysis, adder, differentiator, integrator, active filter, inverter, follower and other application (LTSPICE analysis)	6
Pr4-6	Transistor amplifier – quiescent point, small signal analysis, computer analysis (LTSPICE)	6
Pr7	Voltage regulators (linear and switching) – calculations and computer analysis	2
Pr8-9	Power supply, rectifier - calculations and computer analysis (LTSPICE)	4
Pr10-14	Individual design of a simple electronic circuit (calculations, computer analysis, PCB design, report development)	10
Pr15	summary, repetition	2
	Total hours:	30

TEACHING TOOLS USED
N1. Traditional lecture (chalkboard).
N2. Slide presentation, computer with proper program (eg. PowePoint).
N3. Computer with electronic circuits analysis program (SPICE-like, eg. LTspice)
N4. Design classes in small groups - 12 people (in exceptional cases up to 18 people)

N5. Selfstudy.

N6. Laboratory stations equipped with: laboratory power supply, universal meter, digital oscilloscope, function generator, tools (soldering iron, tweezers, screwdriver, cutters, magnifier), and a set of electronic materials for the exercise (PCB, resistors, capacitors, integrated circuits, etc. .) and specialist equipment depending on the task performed.

N7. Work in pars (in special case 3 persons team)

N8. Consultations.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT		
Evaluation: F — forming (during semester), C — concluding (at semester end)	Learning outcome code	Way of evaluating learning outcome achievement
F1	PEU_W01	Finalt est
F2	PEU_U01	Quizzes and/or homework and/or final test
F3	PEU_U02	Quizzes, implementation of the circuit, measurements and a report on the measurements.
P = (F1 + F2 + F3)/3 (in order to pass the course, allF1 , F2 and F3 must be positive)		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] W. Tietze, Ch. Schenk, Electronic Circuits. Handbook for Design and Applications, Springer, 2009,

[2] P. Horowitz, W. Hill, The Art. Of Electronics, Cambridge University Press 2015

[3] C. Kitchin, L. Counts, A designer's guide to instrumentation amplifier, 3rd edition, Analog Devices , 2006

SECONDARY LITERATURE:

[1] R. L. Boylestad , L.Nashelsky – Electronic Devices and Circuits Theory, Pearson, Prentice Hall, 2012 11th edition

[2] S. Kuta, Elementy i układy elektroniczne, AGH 2000,

[3] A. Malvino, D.J.Bates – Electronic Principles, McGraw Hill, 2008

[4] M. Rusek, J. Pasierbiński, Elementy i układy elektroniczne w pytaniach i odpowiedziach WNT, 2020.

[5] Materials for classes on the website of the subject

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

Jerzy Witkowski, jerzy.witkowski@pwr.edu.pl