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

SUBJECT CARD

Name of subject in Polish: **Wprowadzenie do mikrokontrolerów**
Name of subject in English: **Introduction to microcontrollers**
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: **ECEA00022**
Group of courses: **Yes**

	Lecture	Exercise	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30	15	45		
Number of hours of total student workload (CNPS)	60	60	120		
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		2.0	4.0		
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	1.0	1.0	3.0		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

C1. Gaining basic knowledge of the design of microprocessor systems
C2. Gaining basic knowledge on basic peripherals implemented in the structures of microcontrollers
C3. Gaining basic knowledge of software development on the chosen hardware platform
C4. Acquiring the ability to run applications and its testing in the microprocessor system

SUBJECT LEARNING OUTCOMES
Relating to knowledge: PEU_W01 - knows the rules of operation of the microprocessor PEU_W02 - have knowledge about the main elements of the architecture of the microprocessor PEU_W03 - knows what are the basic elements of microprocessors PEU_W04 - knows the principles for the design of electrical circuits containing microprocessors Relating to skills: PEU_U01 - is able to program microprocessors and microcontrollers in machine language PEU_U02 - is able to program the microprocessors and microcontrollers in a high level language PEU_U03 - is able to develop algorithms and implement them for the selected platform PEU_U04 - is able to take advantage of the major functional blocks of microprocessors

PROGRAM CONTENT		
Lecture		**Number of hours**
Lec1, 2	The basic structure of logical operators and a description using the logic equations, representation of data, number systems	4
Lec3	Introduction to programmable logic structures used in the design process of electronic devices	2
Lec4	Introduction to computer architecture. The implementation of the code and processor architecture	2
Lec5	Processor architecture, flow control. The role of the arithmetic logic unit and an instruction decoder in the microprocessor	2
Lec6, 7	Assembler for the sample platform. Addressing modes of processor systems. The process of compiling, linking and code testing	4
Lec8	The use of high-level languages in the software development process	2
Lec9	Test	2
Lec10	Architecture microcontrollers. Address space, bus, memory types	2
Lec11	The importance of electrical parameters. Power supplies of microprocessors. Sources of resetting and of clocking in the microprocessor systems	2
Lec12	Interrupt system and its importance in microprocessor systems	2
Lec13	The role and implementation of peripheral circuits in the microcontrollers. General-purpose I/O ports and timers	2
Lec14	Overview simple serial buses - SPI, UART	2
Lec15	ADC and DAC in microprocessor systems	2
	Total hours:	30

Exercise		**Number of hours**
Ex1	Introduction to the course. Binary arithmetics.	3
Ex2	Basic logic.	2
Ex3	Logic optimisation	2
Ex4	Design of combinational circuits	2
Ex5, 6	Design of sequential circuits	4
Ex7	Microprocesor	2
	Total hours:	15

Laboratory		Number of hours
Lab1, 2	Introduction to the architecture of the chosen platform and presentation of development environment. The use of assembler and simulator software development process.	6
Lab3	The exchange of data, simple arithmetic and logical operations and control program.	3
Lab4	The use of general purpose ports for the implementation of the interface with the user.	3
Lab5, 6	The use of interrupts in software development for microprocessors. Timers and counters	6
Lab7, 8	The use of synchronous serial bus for communication with external peripheral circuits.	6
Lab9, 10	The use of high-level language to develop software for microprocessors.	6
Lab11, 12	The use of analog-to-digital and digital-to-analog subsystems for measurement and control processes.	6
Lab13, 14	The use of asynchronous serial bus for communication with another module or a PC.	6
Lab15	End test	3
	Total hours:	45

TEACHING TOOLS USED
N1. Lectures using multimedia presentations and whiteboard.
N2. Laboratory classes - discussions on solutions applied.
N3. Class Project - problems discussion
N4. Consultations
N5. Self education

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
1	PEK_W01-04	Final exam
2	PEK_U01-04	Tests and report laboratory exercises
3	PEK_U01-04	Presentations and implementation of the project
P = 0.5*F1+0.25*F2+0.25*F3, (positive grade under condition: F1>2 i F2>2 i F3>2)		

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE:
[1] [1] N. Senthil Kumar, et al., Microprocessors and Microcontrollers, Oxford University Press 2010, ISBN 0198066473
[2] [2] D. Harris, S. Harris, Digital Design and Computer Architecture, Elsevier, 2012, ISBN 0123978165
[3] [3] J. Bear, Microprocessor Architecture, Cambridge University Press, 2009 ISBN 0521769921
[4] [4] W. Smith, C Programming for Embedded Microcontrollers, Elektor 2009, ISBN 0905705804
SECONDARY LITERATURE:
[1] A. Pal, Microcontrollers, Principles and Applications, ISBN: 8120343924

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)
Grzegorz Budzyń, grzegorz.budzyn@pwr.edu.pl