STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Programming of AVR Microcontrollers		**1010802121010832892**
Field of study	Profile of study (general academic, practical)	Year /Semester
Electronics and Telecommunications	**general academic**	**1 / 2**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
Information and Communication	**English**	**elective**
Cycle of study:	Form of study (full-time,part-time)	
Second-cycle studies	**full-time**	
No. of hours		No. of credits
Lecture: **2** Classes: **-** Laboratory: **2** Project/seminars: **-**		**5**
Status of the course in the study program (Basic, major, other)	(university-wide, from another field)	
major	**from field**	
Education areas and fields of science and art		ECTS distribution (number and %)
technical sciences		**5 100%**
Technical sciences		**5 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Has a basic knowledge of the fundamentals of circuit theory, together with necessary mathematical background; this knowledge allows him/her to understand, analyze and evaluate the operation of electrical circuits. Has a basic knowledge about basic electronic elements and theirs characteristics. Have very basic knowledge about measurements and metrology.
2	**Skills**	Is able to extract information from Polish or English language literature, databases and other sources. Is able to use known mathematical analysis, algebra and theory to solve basic problems in electronics.
3	**Social competencies**	Is aware of the limitations of his knowledge and skills; is committed to further self-study. Is active in solving technical electronics problems. Is able to consulting in group.

Assumptions and objectives of the course:

The main point is to teach the students how to design microprocessor-based measurement systems. Upon successful completion of this course, students will know the basic aspects of microprocessor architecture, programming and cooperation with peripherals.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Has knowledge of construction, architecture and practical application of programmable digital circuits. - [K2_W02]

2. Has a systematic knowledge, with the necessary theoretical background, of optimization methods used in solving engineering problems. - [K2_W03]

Skills:

1. Is able to communicate freely in English. Is able to discuss professional matters in English; is able to use knowledgeably English language sources (books, technical and scientific journals, application notes, catalogues, instructions, standards, etc.). - [K2_U01]

2. Is able to prepare a scientific paper or technical report and give a presentation (in English or in Polish) on solving a problem in the area of electronics and/or telecommunication; is able to participate in a discussion related to the presented problem. - [K2_U02]

3. . Is able to select adequate numerical methods and simulation methods to solve typical tasks related to analysis, design and optimization of systems and computational tasks in telecommunication. - [K2_U09]

Social competencies:

1. Understands the legal framework of Polish and international standards in electronics and telecommunications. - [K2_K03]
2. Is aware of the limitations of his/her current knowledge and skills; is committed to lifelong learning. - [K2_K04]
3. Is aware of the necessity to approach solving technical problems with responsibility and professionalism. - [K2_K05]

Assessment methods of study outcomes
1. Projects
2. Reports from laboratory execercises
3. Activity durning labs

Course description
- Decimal and binary numbers, hexadecimal numbers, assembler, tools for assembly programming, simple calculations adding, subtracting and comparing
- Processor architecture, registers, SRAM, stack, stack pointer, bugs with the stack operation
- Linear program execution and branches, macros and subroutines, jumping and branching
- Signed numbers, Binary Code Digits BCD, packed BCD, ASCII format
- Interrupts, interrupt vector addresses, internal and external interrupts
- Timers and counters, 7-segment LED display, n-digit multiplexed LED display
- Ports and peripherals, serial RS232C interface, USART registers, communication with terminal, echo
- SPI interface, exchanging dates between SPI devices
- I2C interface, communication with peripherals
- D/A converters, signal generator, samples in data program memory
- A/D converters, reference voltage, data acquisition, store in SRAM and EPROM
- Multichannel A/D converters, free running and single conversion mode
- Wireless communication, mini-robot controller, acquisition data from robot
- Cooperation with GPS receiver, NMEA commands
- SCPI commands, wireless data acquisition system with digital oscilloscope

Basic bibliography:

1. Richard H. Barnett, Sarah A. Cox, Larry D. OCull, Embedded C Programming and the Atmel AVR, Thomson Delmar Learning, 2002
2. Muhammad Ali Mazidi, AVR Microcontroller and Embedded Systems: Using Assembly and C, Pearson Education.
3. Dhananjay Gadre, Programming and Customizing the AVR Microcontroller, McGraw-Hill, 2000.

Additional bibliography:

1. Claus Kuhnel, AVR RISC Microcontroller Handbook, Newnes, 1998.

Result of average student's workload

Activity	Time (working hours)
1. Lectures	30
2. Labs	30
3. Reports	30
4. Preparation for the exam	30
5. Consulting with the lecturer	3
6. Exam	2

Student's workload

Source of workload	hours	ECTS
Total workload	125	5
Contact hours	65	2
Practical activities	50	2