STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Low-level programming		**1010321361010320104**

Field of study	Profile of study (general academic, practical)	Year /Semester
Electrical Engineering	**general academic**	**3 / 6**

Elective path/specialty	Subject offered in:	Course (compulsory, elective)
Electrical Systems in Mechatronics	**Polish**	**obligatory**

Cycle of study:	Form of study (full-time,part-time)
First-cycle studies	**full-time**

No. of hours					No. of credits
Lecture: **15**	Classes: **-**	Laboratory: **15**	Project/seminars: **-**		**2**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
other	**university-wide**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**2 100%**
Technical sciences	**2 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic knowledge of mathematics, electronics and computer science.
2	**Skills**	Skills of effective self-education in a field related to the chosen field of study, the ability to make the right decisions when designing algorithms and writing the program, the ability to use the Windows operating system on a general level.
3	**Social competencies**	A student is aware of the widening their competence, has a willingness to work in a team, the ability to comply with the rules existing in the classroom lecture and laboratory.

Assumptions and objectives of the course:

1. Provide students with basic knowledge about the operation of processors (construction, instruction set) and microprocessor systems.
2. Provide students with a basic knowledge of binary arithmetic and logic.
3. Gaining the students' ability to write simple programs in assembler language.
4. Developing students' teamwork skills.

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

Knowledge:

1. A student has a basic knowledge of the structure and operation of microprocessor systems and their application in selected industries - [K_W07+++]
2. A student has an elementary knowledge of information technology, used in electrical engineering, the architecture of software and microprocessor systems. - [K_W11+]

Skills:

1. A student can formulate an algorithm and knows how to write a program in assembler. - [K_U04++]
2. A students can use a properly chosen development environments, CPU emulators and programmers. - [K_U13+]

Social competencies:

1. Student can think and act in an entrepreneurial manner in the field of ??electrical engineering. - [K_K04++]

Assessment methods of study outcomes

Lecture:
- Assess the knowledge and skills demonstrated in the form of a written test;
- Continuous assessment for each course (rewarding activity and quality perception).

laboratory:
- Current assessment on each course based on the severity of the problem solution
- Assessment of reports.

Get extra points for the activity in the classroom, and especially for:
- Propose to discuss further aspects of the subject;
- Comments related to the improvement of teaching materials;
- Developed esthetic accuracy reports - in the self-study.

Course description

Construction of the CPU: ALU, registers, ports. ROM and RAM memory.
Binary arithmetic: Binary code, BCD code, U2 code.
Assembler - syntax.
CPU instruction set: arithmetic and logical, branching and jumping, data transfer, bit operations.
Interrupts.

Basic bibliography:

1. Daca W.: Mikrokontrolery od układów 8-bitowych do 32-bitowych, Wyd. NIKOM, Warszawa, kwiecień 2000.
2. Michalski J. A.: Mikroklocki. Mikroprocesory dla początkujących, Wyd. BTC, Warszawa 2007.
3. Doliński J.: Mikrokontrolery AVR w praktyce, Wyd. BTC, Warszawa 2003.
4. Daca W.: Mikrokontrolery od układów 8-bitowych do 32-bitowych, Wyd. NIKOM, Warszawa, kwiecień 2000.
5. Michalski J. A.: Mikroklocki. Mikroprocesory dla początkujących, Wyd. BTC, Warszawa 2007.
6. Doliński J.: Mikrokontrolery AVR w praktyce, Wyd. BTC, Warszawa 2003.
7. Gonera P.: ARM Assembly Language: Fundamentals and Techniques, Helion 2014
8. Bieliński A.: Aplikacje graficzne na mikrokontroler 89c52, 89s52, 89c55wd, 89c51rb2, 89c51rc2, 89c51rd2, 89c51ed2. Oprogramowanie narzędziowe i aplikacje dla bootloaderów i systemów ISP (ebook), Helion, 2016

Additional bibliography:

1. Doliński J.: Mikrokontrolery AVR - niezbędnik programisty, Wyd. BTC, Legionowo 2009.
2. Pasierbiński J., Zbysiński P.:Układy programowalne w praktyce, Wyd. WKŁ, Warszawa 2002.
3. Doliński J.: Mikrokontrolery AVR - niezbędnik programisty, Wyd. BTC, Legionowo 2009.
4. Pasierbiński J., Zbysiński P.:Układy programowalne w praktyce, Wyd. WKŁ, Warszawa 2002.

Result of average student's workload

Activity	Time (working hours)
1. participation in lectures	15
2. participation in laboratory	15
3. participation in consultations	5
4. preparation for laboratory	6
5. making reports	10
6. preparation for the pass of lectures	6
7. presence at the lecture exam	3

Student's workload

Source of workload	hours	ECTS
Total workload	60	2
Contact hours	38	1
Practical activities	32	1