

FACULTY OF ELECTRICAL  
ENGINEERING**SUBJECT CARD**

Name in Polish: **Podstawy techniki mikroprocesorowej 1**  
 Name in English: **Fundamentals of microprocessors 1**  
 Main field of study (if applicable): **Control Engineering and Robotics**  
 Specialization (if applicable):  
 Level and form of studies: **1st level, full-time**  
 Kind of subject: **obligatory**  
 Subject code: **ARR043238**  
 Group of courses: **NO**

|  | Lecture              | Classes | Laboratory           | Project | Seminar |
|--|----------------------|---------|----------------------|---------|---------|
| Number of hours of organized classes in University (ZZU):                        | 15                   |         | 15                   |         |         |
| Number of hours of total student workload (CNPS):                                | 60                   |         | 30                   |         |         |
| Form of crediting:   | crediting with grade |         | crediting with grade |         |         |
| For group of courses mark (X) final course:                                      |                      |         |                      |         |         |
| Number of ECTS points:   | 2                    |         | 1                    |         |         |
| including number of ECTS points for practical (P) classes :                      |                      |         | 1                    |         |         |
| including number of ECTS points for direct teacher-student contact (BK) classes: | 1.40                 |         | 0.70                 |         |         |

**PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES**

1. The student knows fundamental concepts of computer science.
2. The student knows the principles for the design of algorithms to solve engineering tasks.

**SUBJECT OBJECTIVES**

- C1. Acquisition of basic knowledge of microprocessor system architecture, addressing modes, numerical codes, types of memory, microprocessors typical internal systems (AC converters, counters, interrupt systems).
- C2. Getting microprocessor programming skills, formulation of algorithms and their software implementation.
- C3. The acquisition and consolidation of social skills including emotional intelligence involving the ability to work in a group of students with a view to effective problem solving. Responsibility, honesty and fairness in the life, following of academic and social rules.

**SUBJECT EDUCATIONAL EFFECTS***relating to knowledge:*

- PEK\_W01 Student knows the basic principle of operation and the internal systems of microprocessors.
- PEK\_W02 Student knows the fundamental numeric codes used in microprocessor-based systems.
- PEK\_W03 Student knows the principle of operations of different internal systems (A / D converters, timers, interrupts systems).

*relating to skills:*

- PEK\_U01 Student can choose the proper software for different kinds of processors.
- PEK\_U02 Student can program processor internal systems to work with different types of peripherals.
- PEK\_U03 Student can run the programs, tests them using the appropriate software and hardware tools.

*relating to social competences:*

- PEK\_K01 The acquisition and consolidation of competence in the independent and creative thinking.

## PROGRAMME CONTENT

| Form of classes - lecture |   | Number of hours: |
|---------------------------|---|------------------|
| Lec 1                     | Organizational matters. The basic elements of microprocessors. Instruction cycle processor, pipelining.                     | 2                |
| Lec 2                     | Architecture of microprocessor systems. The types of memory used in microprocessor systems and their characteristic values. | 2                |
| Lec 3                     | Arithmetics of microprocessor systems. Numerical codes used in microprocessor systems.                                      | 2                |
| Lec 4                     | Cooperation microcontroller with external systems. Construction and operation of I/O ports.                                 | 2                |
| Lec 5                     | Interrupt system microcontroller. Programming the LCD display.  | 2                |
| Lec 6                     | Construction and programming of the internal A/D converter.   | 2                |
| Lec 7                     | Construction and programming of time-counting system microcontroller. Generating PWM.                                       | 2                |
| Lec 8                     | Assessment.   | 1                |
| Total hours:              |   | <b>15</b>        |

| Form of classes - laboratory |  | Number of hours: |
|------------------------------|--|------------------|
| Lab 1                        | Organization matters. Getting to know the safety rules. Getting to know the positions of laboratory equipment hardware and software environment. | 2                |
| Lab 2                        | Arithmetic and logical operations, working with memory microcontroller.  | 4                |
| Lab 3                        | Programming of I/O ports of the microcontroller, control LED ruler.  | 4                |
| Lab 4                        | Programming the LCD.   | 4                |
| Lab 5                        | Assessment.  | 1                |
| Total hours:                 |  | <b>15</b>        |

## TEACHING TOOLS USED

- N1. Traditional lectures using multimedia techniques.  
 N2. Consultation.  
 N3. Own work.  
 N4. Lecture - credit.  
 N5. Verification of knowledge with a short quiz.  
 N6. Laboratory - credit.

## EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

| Evaluation<br><i>F - forming (during semester)<br/>P - concluding (at semester end)</i> | Educational effect number                      | Way of evaluating educational effect achievement |
|---|--|--|
| F1(W)   | PEK_W01<br>PEK_W02<br>PEK_W03                  | Final test.                                      |
| P(W)  | P=F1   |  |
| F1(L)   | PEK_U01<br>PEK_U02<br>PEK_U03                  | Active participation.                            |
| F2(L)   | PEK_U01<br>PEK_U02<br>PEK_U03                  | Written tests.                                   |
| F3(L)   | PEK_U01<br>PEK_U02<br>PEK_U03                  | Rate of programs.                                |
| P(L)  | $P=0,2 \cdot F1 + 0,3 \cdot F2 + 0,5 \cdot F3$ |  |

## PRIMARY AND SECONDARY LITERATURE

### PRIMARY LITERATURE:

- [1] Baranowski R., Mikrokontrolery AVR ATmega w praktyce, Wyd. BTC, Legionowo, 2005  
 [2] Biernat J., Metody i układy arytmetyki komputerowej, Wyd. Politechniki Wrocławskiej, 2001  
 [2] Dyrz, Czesław T. Kowalski, Zdzisław Żarczyński, Podstawy techniki mikroprocesorowej, Wyd. P.Wr., 1999  
 [3] Kardaś M., Mikrokontrolery AVR. Język C - podstawy programowania. Wydanie II poprawione i uzupełnione, Wyd. ATNEI, 2013

### SECONDARY LITERATURE:

- [1] Doliński J., Mikrokontrolery AVR w praktyce, Wyd. BTC, Warszawa 2004  
 [2] Francuz T., Język C dla mikrokontrolerów AVR: od podstaw do zaawansowanych aplikacji, Wyd. Helion, Gliwice, 2011  
 [3] www.atmel.com

**SUBJECT SUPERVISOR**

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**MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
ARR043238 - Fundamentals of microprocessors 1  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY Control Engineering and Robotics**

| <b>Subject educational effect</b> | <b>Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)</b> | <b>Subject objectives</b> | <b>Programme content</b>   | <b>Teaching tool number</b>            |
|-----------------------------------|--|---------------------------|--|--|
| PEK_W01                           | K1AiR_W29  | C.1                       | Lec1<br>Lec2<br>Lec3<br>Lec4<br>Lec5<br>Lec6<br>Lec7<br>Lec8   | N.1<br>N.2<br>N.3<br>N.4               |
| PEK_W02                           | K1AiR_W29  | C.1                       | Lec1<br>Lec2<br>Lec3<br>Lec4<br>Lec5<br>Lec6<br>Lec7<br>Lec8   | N.1<br>N.2<br>N.3<br>N.4               |
| PEK_W03                           | K1AiR_W29  | C.1                       | Lec1<br>Lec2<br>Lec3<br>Lec4<br>Lec5<br>Lec6<br>Lec7<br>Lec8   | N.1<br>N.2<br>N.3<br>N.4               |
| PEK_U01                           | K1AiR_U25  | C.2                       | Lab1<br>Lab2<br>Lab3<br>Lab4<br>Lab5   | N.3<br>N.5<br>N.6                      |
| PEK_U02                           | K1AiR_U25  | C.2                       | Lab1<br>Lab2<br>Lab3<br>Lab4<br>Lab5   | N.3<br>N.5<br>N.6                      |
| PEK_U03                           | K1AiR_U25  | C.2                       | Lab1<br>Lab2<br>Lab3<br>Lab4<br>Lab5   | N.3<br>N.5<br>N.6                      |
| PEK_K01                           | K1AiR_K03  | C.3                       | Lec1<br>Lec2<br>Lec3<br>Lec4<br>Lec5<br>Lec6<br>Lec7<br>Lec8<br>Lab1<br>Lab2<br>Lab3<br>Lab4<br>Lab5 | N.1<br>N.2<br>N.3<br>N.4<br>N.5<br>N.6 |