FACULTY OF ELECTRICAL ENGINEERING

SUBJECT CARD

Name in Polish:	**Sterowniki mikroprocesorowe w energetyce**
Name in English:	**Microprocessor controllers in electrical power engineering**
Main field of study (if applicable):	**Industrial Control Engineering**
Specialization (if applicable):	**Automation and Control in Electrical Power Systems**
Level and form of studies:	**2nd level, full-time**
Kind of subject:	**obligatory**
Subject code:	**APR012117**
Group of courses:	**NO**

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. relating to knowledge: Basic knowledge of C language, basic knowledge of A/D and D/A conversion. relating to skills: Basic practical skills in C programming. relating to social competencies: Ability of creative thinking and working. Ability of team working

SUBJECT OBJECTIVES

C1. Knowledge of structure, operation and programming rules ARM microprocessor family.

C2. Practical ability of programming in C language microprocessor peripheral circuits. Especially practical implementation.

C3. The practical implementation of selected real time algorithms of power systems protections like: measuring data collection, amplitude measurement, undervoltage and overcurrent protection, digital filters of criterial data.

C4. Ability of practical team working: algorithms creation and programming.

SUBJECT LEARNING OUTCOMES

relating to knowledge:

relating to skills:

PEU_U01 Student has the ability to use and programme (in C language) microprocessor peripheral circuits.

PEU_U02 Student can independently, based on an existing microprocessor, execute a simple task, or part of a complex task from basic power system protection.

relating to social competences:

PEU_K01 Student can competently cooperate in the group that develops a complex project using microprocessor controller.

PROGRAMME CONTENT		
Form of classes - laboratory		**Number of hours:**
Lab 1	Presentation of the Rules of Procedure Health and Safety Laboratory. Establish rules for passing. General knowledge of the laboratory stand. Discussion of the software environment. The rules for creating new projects. Documentation own programmes. Discussion of the structure of the program. Compilation of the program. Getting to know the simulator. Developing a program in microprocessor memory.	2
Lab 2	The digital outputs handling: port operations, light and acoustic signalling, alphanumeric displays.	2
Lab 3	The digital inputs handling: port operations, keyboard, sensors. Counting circuits: event counters, timers, real-time clock RTC.	2
Lab 4	The digital inputs handling: port operations, keyboard, sensors. Counting circuits: event counters, timers, real-time clock RTC. (continued)	2
Lab 5	Emergency and accidental event handling: interrupts.	2
Lab 6	Management of analogue signals: A/D and D/A converters.	2
Lab 7	Measurement data real-time registration.	2
Lab 8	The implementation of signal amplitude measurement algorithm.	2
Lab 9	The implementation of signal frequency measurement algorithm.	2
Lab 10	The implementation of the undervoltage and overcurrent protection algorithm.	2
Lab 11	The implementation of the digital filter algorithms for selected size criterion.	2
Lab 12	The implementation of the passing project.	2
Lab 13	The implementation of the passing project. (continued)	2
Lab 14	The implementation of the passing project. (continued)	2
Lab 15	The implementation of the passing project. (continued)	2
	Total hours:	**30**

TEACHING TOOLS USED
N1. Microprocessor development kit.
N2. Programming environment for editing, compiling and running programs for microprocessor controllers.
N3. The presentation of the passing project.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT		
Evaluation *F – forming (during semester)* *P – concluding (at semester end)*	**Educational effect number**	**Way of evaluating educational effect achievement**
F1(L)	PEU_U01 PEU_U02	Attendance on classes
F2(L)	PEU_U01 PEU_U02 PEU_K01	Assessment of the correctness of the algorithms used in the implementation of the final project.
P(L)	P = 0,3F1 + 0,7F2	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Bryndza L., LPC2000 Mikrokontrolery z rdzeniem ARM7, BTC, Warszawa 2007.
[2] Stawski E., Mikrokontrolery LPC2000 w przykładach, BTC, Warszawa 2009.
[3] Mikrokontrolery z rdzeniami ARM, Elektronika Praktyczna, wydanie specjalne 1/2006, AVT, Warszawa 2006
[4] LPC2131/2132/2138 Data Sheet, Philips*
[5] LPC2131/2132/2138 User Manual, Philips*
[6] Opis zestawu uruchomieniowego ZL6ARM firmy BTC, Warszawa, 2007*

* literature available from teacher

SECONDARY LITERATURE:

[1] Bryndza L., Mikrokontrolery z rdzeniem ARM9 w przykładach", BTC, Warszawa 2009.
[2] Kernighan B.W., Ritchie D.M., Język ANSI C", WNT, Warszawa 2007.
[3] Majewski J., Kardach K., Programowanie mikrokontrolerów z serii 8x51 w języku C", Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2002

SUBJECT SUPERVISOR

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