STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Application of microcontrollers and PLC controllers in**		Code **1010325341010326094**
Field of study **Electrical Engineering**	Profile of study (general academic, practical) **(brak)**	Year /Semester **2 / 4**
Elective path/specialty **Measurement Systems in Industry and**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**
Cycle of study: **Second-cycle studies**	Form of study (full-time,part-time) **part-time**	
No. of hours Lecture: **-** Classes: **-** Laboratory: **18** Project/seminars: **18**		No. of credits **4**
Status of the course in the study program (Basic, major, other) **(brak)**	(university-wide, from another field) **(brak)**	
Education areas and fields of science and art **technical sciences** **Technical sciences**		ECTS distribution (number and %) **4 100%** **4 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic knowledge in the scope of electrotechnics, metrology and computer science. Basic knowledge in the scope of electronics, including knowledge of electronic analog and digital systems.
2	**Skills**	Basis of programming languages Ability of the efficient self-education in the area of programming of microcontrollers and PLC controllers
3	**Social competencies**	Awareness of the necessity of competence broadening and ability to show readiness to work as a team

Assumptions and objectives of the course:

- Knowledge of programming bases of the selected PLC controlles and possibilities of the modern 8-bit microcontrollers for measurement techniques.
- Knowledge of interdisiplinary achievements in the area of industrial applications of microcontrollers and PLC controllers.

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

Knowledge:

1. Ability to describe the application range and potential of the modern measuring systems - [K_W08 +++, K_W11 +, K_W18 +]
2. Ability to explain the principles and techniques of the acquisition and processing measuring signals in the present industrial applications - [K_W11 +]

Skills:

1. Ability to design creatively the modern measurement systems, using possibilities offered by available techniques, taking into account the limitations of the present status of knowledge and technique - [K_U01 +]
2. Ability to work independently and as a team in the design and construction companies, research laboratories and industrial centers - [K_U02 +, K_U11 +]

Social competencies:

1. Understanding a need of the broad popularization of the knowledge in the area of simple and complex measurement systems used in industry and biomedical engineering - [K_K02 ++]

Assessment methods of study outcomes

Laboratory exercises:

- initial tests and awarding the knowledge needed to solve problems given in the scope of laboratory tasks,
- continuous evaluation, at all classes,and awarding the skill increase in the use of the known principles and methods,
- evaluation of the knowledge and skills related to a given measuring the report prepared.

Projects:

- continuous evaluation, at all classes,and awarding the skill increase in the use of the known principles and methods,
- evaluation of the knowledge and skills related to a given group or independent project and evaluation of the prepared report.

Course description

Updating 2017:

Methods of education are orientated to students to motivate them to participate actively in education process by discussion and reports.

Laboratory:

Detailed reviewing of particular exercises reports. Realization of laboratory tasks in teams, taking into account the specific computational experiments.

Projects:

Groups of students work as teams. Discussion on different methods and aspects of problem solutions. Detailed reviewing of particular projects documentation.

- Construction of measuring systems with the use of PLC controllers.
- Languages of PLC controllers programming.
- Bases of programming, operations on data, signal processing, controllers communications.
- Examples of measurement systems configurations with a PLC controller.
- Application of microcontrollers in measurement systems.
- Internal architecture of microcontrollers.
- Internal I/O devices of microcontrollers.
- Configuration of a microprocressor system.
- Measurement applications with the use of internal I/O sources.
- Cooperation between a microcontrller with external devices.
- Languages of microcontroller programming: ASEMBLER and "C".
- Presentation of starting means, programming means for cooperation with microcontrollers,and network sources concerning the problems with microcontrollers.

Basic bibliography:

1. R. Sałat, K. Korpysz, P. Obstawski, Wstęp do programowania sterowników PLC, WKŁ, Warszawa 2010.
2. J. Kasprzyk, Programowanie sterowników przemysłowych, WNT, Warszawa 2006.
3. A. Król, J. Moczko-Król, S5/S7 Windows Programowanie i symulacja sterowników PLC firmy Siemens, Nakom, Poznań 2002.
4. R. Baranowski, Mikrokontrolery AVR ATmega w praktyce, Wyd. BTC, Warszawa 2005
5. T. Zieliński, Cyfrowe przetwarzanie sygnałów. Od teorii do zastosowań, WKŁ, Warszawa 2007
6. Hulewicz A., Sterowniki PLC w systemach zarządzania inteligentnym budynkiem, Przegląd Elektrotechniczny, nr 1a/2013, s. 108-110
7. Hulewicz A., Krawiecki Z., Sterownik PLC i panel operatorski w układzie automatyki inteligentnego budynku, , Poznan University of Technology Academic Journals, Electrical Engineering, No 92, Poznań 2017, s. 345-354.
8. Hulewicz A., Krawiecki Z., Parzych J., Przykłady niekonwencjonalnych zastosowań sterowników PLC, Poznan University of Technology Academic Journals, Electrical Engineering, No 91, Poznań 2017, s. 81-92.

Additional bibliography:

1. U. Tietze, Ch. Schenck, Układy półprzewodnikowe, WNT, Warszawa 1993.
2. J. Bogusz, Lokalne interfejsy szeregowe w systemach cyfrowych, Wyd. BTC, Warszawa 2004.
3. J. Szabatin, Podstawy teorii sygnałów, wyd. 3, WKŁ, Warszawa 2000

Result of average student's workload

Activity	Time (working hours)

1. Participation in laboratory exercises	18
2. Participation in projects classes	18
3. Participation in consulting with lecturers	5
4. Preparation to laboratoryexercises and preparation of the reports	25
5. Realization of projects	34
6. Credit of projects	3

Student's workload		
Source of workload	**hours**	**ECTS**
Total workload	103	4
Contact hours	44	2
Practical activities	95	4