



Name of module/subject	Code
<b>Embedded systems</b>	

### COURSE DESCRIPTION CARD

Field of study: <b>Computing science</b>		Training profile (general academic/practical): <b>practical</b>	Year / Semester: <b>III/6</b>
Specialization: <b>IT systems</b>		Subject offered in: <b>Polish</b>	Course (obligatory/optional): <b>obligatory</b>
No. of lecture hours: 65 No. of self-studying hours: 25		ECTS: <b>3</b> <b>1</b>	
<b>Cycle of studies:</b> first	<b>Form of studies</b> weekends Full time	<b>Field of studies</b> technical sciences, computer science, automation and robotics, electronics, telecommunications, electrotechnics, mathematics	
Status of subject in curriculum (basic, specialized, other) <b>Basic sciences</b>		(general academic, from other department) <b>/ general academic</b>	
Unit providing the training: <b>Institute of Computing Science and Telecommunication</b>			
Lecturer in charge of the subject: dr inż. Przemysław Zakrzewski e-mail: <a href="mailto:przemyslaw.zakrzewski@cs.put.poznan.pl">przemyslaw.zakrzewski@cs.put.poznan.pl</a> phone: 61 424 2942			
<b>Initial requirements in knowledge, skills, social competences:</b>			
1	<b>Knowledge:</b>	Basic knowledge in the field of automation, computer architecture, microcontrollers.	
2	<b>Skills:</b>	Ability to effectively self-educate in the fields related to computer science as a selected field of study.	
3	<b>Social competences:</b>	He is aware of the need to broaden his competences and readiness to cooperate within the team.	
<b>The aim of the subject:</b> Understanding the principles of operation of discrete control systems using a computer as a control device and principles of construction and design of embedded systems.			
<b>Training outcomes</b>			
<b>Knowledge</b> As a result of the training course a student is able to:			Reference to field-related training outcomes
1	Define the basic concepts of computer control systems, classification and hardware requirements.		<b>K_W14 +++</b>
2	The ability to effectively self-study in fields related to the subject as a chosen field of study.		<b>K_W19 +++</b>

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3	Student is aware of the need to broaden his competences and readiness to cooperate within the team.	<b>K_W14 ++</b>
4	Provide and describe examples of applications of embedded systems	<b>K_W20 +++</b>

<b>Skills</b> As a result of the training course a student is able to:		Reference to field-related training outcomes	
1	Describe the typical structures of computer control systems	<b>K_U09 +++</b>	
2	Formulate requirements for the software of computer control systems	<b>K_U09 +++</b>	
3	Program the PLC in the field of classic control algorithms	<b>K_U16 ++</b> <b>K_U09 +++</b>	
<b>Competences</b> As a result of the training course a student is able to:		Reference to field-related training outcomes	
1	Understands the need for permanent education and communication in a comprehensible way information with the immediate environment in the professional activity.	<b>K_K01</b>	
2	Understands non-technical (including ecological) effects of its operation and its impact on the environment, especially in the field of embedded systems.	<b>K_K02</b>	
3	Obtained knowledge will allow him to creatively work in the field of automation of work that is burdensome for humans with the use of simple PLCs or microcontrollers.	<b>K_K04</b>	
<b>Accepted grading criteria</b>			
<b>Local grade</b>	<b>Local definition</b>	<b>ECTS grade</b>	<b>ECTS definition</b>
5	Bardzo dobry [very good]– perfect knowledge, skills, competences	A	Celujący [exemplary] – extraordinary achievements
4,5	Dobry plus [good plus]– very good knowledge, skills, competences	B	Bardzo dobry [very good] – above average standards with some mistakes
4	Dobry [good] – good knowledge, skills, competences	C	Dobry [good] – general good work with some noticeable mistakes
3,5	Dostateczny plus [satisfactory plus] – satisfactory knowledge, skills, competences but with significant shortcomings	D	Zadawalający [satisfactory] – satisfactory but with significant mistakes
3	Dostateczny [satisfactory] – satisfactory knowledge, skills, competences but with numerous shortcomings (threshold 60% of the requirements)	E	Dostateczny [satisfactory] – outcomes meet minimal criteria

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2	Niedostateczny [insufficient] – insufficient knowledge, skills and competences (below 60% of the requirements)	FX, F	Niedostateczny [insufficient] – basic shortcomings in material
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### Assumed grading methods

#### Diagnosing assessment:

- Current control of knowledge in the preparation for the next stages of the exercise

#### Formative assessment:

- Evaluation of creativity in approach to solving a given project problem

#### Summative assessment:

- An exam consisting of approximately 10-12 questions with different point values covering the entire lecture content

#### Curriculum content:

Basics of computer control systems: basic concepts, classification, direct and superior control systems, hardware layer (structure and construction of automation channel, microcontrollers, PLC controllers), software layer (real-time operating systems). Synthesis of discrete control algorithms: classic PID algorithms, minimal-time algorithms, artificial intelligence algorithms. Methodology of embedded systems design. Designing reliable systems.

#### Self-studying:

Data processing and energy consumption. Characteristics of project documentation. Examples of applications of embedded systems: smart metering systems, intelligent building systems.

#### Main bibliography:

1. Urbaniak A. i in., Systemy wbudowane – wykład multimedialny, Poznań 2006  
<http://wazniak.mimuw.edu.pl>
2. Urbaniak A., Komputerowe wspomaganie eksploatacji obiektów i procesów w systemach zaopatrzenia w wodę i oczyszczania ścieków, Wyd. PAN Komitet Inżynierii Lądowej i Wodnej, Warszawa 2016

#### Supplementary bibliography:

1. Niederliński A., Systemy komputerowe automatyki przemysłowej, WNT, Warszawa 1987
2. Marwedel P., Embedded System Design, Kluwer Academic Publisher, Boston 2003
3. Ting-pat So Albert, Lok Chan Wai, Intelligent Building Systems, Kluwer Academic Publisher, Boston 1999



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<b>Student's involvement</b>		
<b>Form of activity</b>	<b>Hours</b>	<b>ECTS</b>
Total number of hours	90	4
Hours requiring direct contact with a lecturer	65	3
Activities requiring self-studying	25	1