STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Embedded systems	**1010511351010509051**

Field of study	Profile of study (general academic, practical)	Year /Semester
Computing	**general academic**	**3 / 5**
Elective path/specialty	**Subject offered in:**	**Course (compulsory, elective)**
-	**Polish**	**elective**

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

No. of hours	No. of credits
Lecture: **30** Classes: **-** Laboratory: **30** Project/seminars: **-**	**5**

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

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**5 100%**
Technical sciences	**5 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Student starting this course should have basic knowledge of mathematical analysis, basics of automation, organization of computer systems and operating systems.
2	**Skills**	The student should have the skills to acquire information from the indicated sources, the to logical thinking, drawing conclusions as well as logical and concise presentation of information.
3	**Social competencies**	The student should be honest, responsible, persistent, cognitive, creative, polite and respectful for other people.

Assumptions and objectives of the course:

1. To provide students the basic knowledge in the field of the theory and transmission of signals, the basics of computer control systems, hardware and software of embedded systems and principles of their design.
2. Developing students' skills in solving simple problems related to the use of embedded systems and increasing the reliability of such systems.
3. Teaching students the skills of teamwork in an interdisciplinary team, especially in cooperation with process technologists.

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

Knowledge:

1. The student has structured, theoretically founded general knowledge in the field of embedded systems as well as related data transmission and digital signal processing topics - [K1st_W4]
2. The student formulates and describes examples of applications of embedded systems and signal processing systems - [K1st_W5]
3. The student formulates requirements for embedded systems software regarding: I/O, human-computer communication, operating system, control algorithms, diagnostics as well as signal acquisition and transmission. - [K1st_W6]
4. The student knows the basic methods, techniques and tools used to solve simple IT tasks in the field of embedded systems and simple tasks related to the representation of signals in time and frequency domains. - [K1st_W7]

Skills:

1. The student is able to plan and carry out experiments, including computer measurements and simulations, interpret the obtained results and draw conclusions. - [K1st_U3]
2. The student is able - according to the given specification - to design and implement a simple IT system using appropriate methods, techniques and tools, including signal processing tools - [K1st_U10]
3. The student has the ability to implement simple embedded systems and tasks in the field of DSP, e.g. digital filtration. - [K1st_U13]

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Social competencies:
1. The student understands the need for permanent education and communication in a comprehensible way information with the immediate environment in the professional activity. - [K1st_K1]
2. the student is aware of the importance of knowledge in solving engineering problems and knows examples and understands the reasons for malfunctioning IT systems that led to serious financial and social losses or to serious health conditions or even to death - [K1st_K2]
3. the student can think and act in an entrepreneurial way, including finding commercial applications for the created embedded systems, bearing in mind not only business but also social benefits of the business run - [K1st_K3]

Assessment methods of study outcomes
The student may obtain additional credits for being active during classes, and especially for:
? discussing additional aspects of the issue,
? effectiveness of applying the acquired knowledge for solving given problems,
? ability to cooperate within a team when realizing a detailed task in laboratory,
? comments improving didactic materials,
? indicating student's perceptual difficulties enabling ongoing improvement of the didactic process.

Course description
Basics of signal theory. Sampling of continuous signals - Shannon's theorem. Discrete Fourier Transform. Digital filtration. Basics of signal transmission.
Basics of computer control systems: basic concepts, classification, direct and superior control systems, layered control structure (structure and construction of automation channel, microcontrollers, PLC controllers). Embedded systems software: requirements and their implementation. Synthesis of discrete control algorithms: classic PID control algorithms. Design of embedded systems. Optimization of energy consumption. Characteristics of the project documentation: requirements of the project description standard. Examples of applications of embedded systems.

Basic bibliography:

1. Embedded Systems Design, Marwedel P., Kluwer Academic Publisher, Boston, 2003
2. Understanding Digital Signal Processing (in Polish), R.G. Lyons, WKŁ, Warszawa, 2000
3. Introduction to digital signal processing, J. Walczak, D.Grabowski, M. Maciążek, Wydawnictwo. Wydawnictwo Politechniki Śląskiej, 2013. Dodaj do listy podr. Dodaj do listy podr.

Additional bibliography:

1. Computer systems for automation and control, Olsson G., Piani G., Prentice Hall, 1992
2. Communication systems, S. Haykin, John Wiley & Sons, 1994.

Result of average student's workload

Activity	Time (working hours)
1. participation in lectures:	30
2. participation in laboratory classes:	30
3. preparation for laboratory classes:	15
4. completing (as part of student	5
5. participation in consultations related to the implementation of the education process, in particular laboratory classes / project:	2
6. implementation of algorithms, launching and verification of the application (time outside laboratory classes):	5
7. reading the indicated literature and didactic materials:	10
8. preparation for the exam and presence at the exam: 8 hours. + 2 hours	10

Student's workload

Source of workload	hours	ECTS
Total workload	117	5
Contact hours	64	3
Practical activities	45	2

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