COURSE DESCRIPTION CARD - SYLLABUS

Course name
Embedded systems [S1Inf1>SWang]

Course

Field of study
Computing

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
English

Form of study
full-time

Requirements
elective

Number of hours

Lecture
30

Laboratory classes
24

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

5,00

Coordinators

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Lecturers

Prerequisites

Student starting this course should have basic knowledge of mathematical analysis, basics of control engineering, computer architecture and operating systems. He/she should have the skills to acquire knowledge from the indicated sources, to logical thinking, to drawing conclusions and to concise presentation of information. He/she should be honest, responsible, persistent, cognitive, creative, polite and respectful for other people.

Course objective

1. Providing students the basic knowledge in the field of signal processing and transmission, 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 interdisciplinary teamwork , especially in the proces of project design and implementation.

Course-related learning outcomes

Knowledge:
1. The student has structured, theoretically founded general knowledge in the field of embedded systems as well as in the related data transmission and digital signal processing topics - [K1st_W4]
2. The student can formulate and describes examples of applications of embedded systems and signal processing systems - [K1st_W5]
3. The student can formulate requirements for embedded systems software regarding: I/O, human-computer communication, operating systems, control algorithms, diagnostics and signal acquisition and transmission. - [K1st_W6]
4. The student knows basic methods, techniques and tools used to solve simple IT tasks in the field of embedded systems and tasks related to the signal processing 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 signal processing tasks, e.g. digital filtration. - [K1st_U13]

Social competences:
1. The student understands the need for life long learning and for the ability to communicate in a comprehensible way co-workers in the professional activity. - [K1st_K1]
2. The student is aware of the importance of knowledge in solving engineering problems, knows examples and understands the reasons for malfunctioning of IT systems that led to serious financial and social losses or to serious health conditions and 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 - [K1st_K3]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures:
a) formative evaluation - based on answers to questions concerning contents presented in previous lectures, b) evaluation summary - the knowledge and skills assessed in the written exam (consisting of about 10-12 questions variously scored, covering the entire lecture content) . Passing threshold: 50% of scores. Examination issues, on the basis of which the questions are developed, will be sent to students by e-mail using the university's e-mail system.
Laboratories :
a) formative evaluation - based on the quality of lab tasks execution;
b) evaluation summary - based on the assessment of student's preparation for lab sessions, lab sessions execution and reports, as well as the quality of the project together with project report and its defense; the quality of team work will be also assessed.
It is possible to obtain additional scores for the active participation in classes, especially for discussing additional aspects of the program enabling ongoing improvement of the teaching process, the effectiveness of applying the acquired knowledge when solving a practical problem, comments related to the possible improvement of teaching method, indicating students' perceptual difficulties

Programme content

Basics of signal processing theory. Sampling of continuous signals - Shannon's theorem. Discrete Fourier Transform. Digital filtration. Basics of data baseband and broadband transmission (modulation types). Fundamentals of computer control systems: basic concepts, classification, direct and overriding 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.

Course topics

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Teaching methods

1. Lecture: multimedia presentation illustrated with examples presented on the blackboard.
2. Laboratory exercises:
- multimedia presentation illustrated with examples presented on the blackboard and carrying out the tasks given by the teacher
- practical exercises;
- team project presenting the application of acquired knowledge

Bibliography

Basic:
1. Embedded systems - multimedia lecture (in Polish), Urbaniak A. et al., http://wazniak.mimuw.edu.pl, Poznań, 2006
2. Industrial computer control systems (in Polish), Niederliński A., WNT, Warsaw, 1987
3. Embedded System Design, Marwedel P., Kluwer Academic Publisher, Boston, 2003
4. Control and systems theory (in Polish), Kaczorek T., PWN, Warszawa, 1996
5. Wprowadzenie do cyfrowego przetwarzania sygnałów, R.G. Lyons, WKŁ, Warszawa, 2000, lub Wyd. 2. rozszerzone, 2010;
English version: Understanding Digital Signal Processing, Addison Wesley, 3rd edition, 2010
6. Basics of digital telecommunications systems (in Polish), K. Wesołowski, WKŁ, Warszawa 2006

Additional:
1. Computer systems for automation and control, Olsson G., Piani G., Prentice Hall, 1992
2. Systemy Telekomunikacyjne, S. Haykin, WKŁ, 2004;
3. Digital Communication Systems , S Haykin, Wiley, 2013

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,00
Classes requiring direct contact with the teacher	54	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	71	3,00