COURSE DESCRIPTION CARD - SYLLABUS

Course name
Embeded Systems [S1MiKC1>SW]

Course

Field of study
Microelectronics and digital communications

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
15

Number of credit points

3,00

Coordinators

dr inż. Adam Grzelka
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Lecturers

Prerequisites

Has basic knowledge of circuit theory and semiconductor circuits. Has basic knowledge of microcontroller programming. Has basic knowledge of digital circuit programming. Has basic knowledge of wired and wireless transmission methods/protocols. Is able to obtain information from literature and databases and other sources, such as technical documentation, in Polish or English. Able to use programming languages such as Verilog, C/C++ and Python. Can analyze code in low-level programming languages. Knows the limitations of his/her own knowledge and skills, understands the need for further training. Can carry out team projects.

Course objective

To learn about the design and features of selected embedded systems. To become familiar with basic implementations of embedded systems (e.g. PLCs, programmable logic controllers, configurable and programmable systems). Introduction to a group of communication interfaces developed for embedded systems (e.g. Network on a chip, AXI4). Practical application of embedded systems, their design and implementation in relation to new technologies (e.g. neural networks).

Course-related learning outcomes

Knowledge:
Has knowledge of the construction and programming and operation of embedded systems. K1_W02, K1_W03, K1_W05, K1_W12
Has knowledge of the design and parameters of the communication network designed to support the peripherals of an embedded system. K1_W06, K1_W13
Has knowledge of the prectical implementation of systems using neural networks, among others. K1_W08

Skills:
Has the ability to analyze and design an embedded system taking into account the imposed requirements. K1_U01, K1_U02, K1_U05, K1_U11, K1_U13
Able to run the system using compilation tools and and provided or self-provided software libraries and documentation. K1_U05 , K1_U11
Can determine the requirements for the communication link depending on the type and importance of the transmitted data between sensors/detectors and the management system. K1_U09, K1_U13

Social competences:
He is open to opportunities for continuing education and understands the need to improve professional competence. K1_K01
Has basic knowledge necessary to understand non-technical conditions of engineering activities; K1_K03
Knows the basic principles of health and safety at work. K1_K04
Has a sense of responsibility for designed electronic and telecommunication systems. K1_K02

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: written exams. The written exam consists of 6-10 closed and open questions. Each question is scored according to its complexity. A short descriptive answer or marking the correct answers of a closed question is expected.
Alternatively, with the consent of the instructor, the possibility of passing the course in the form of a written, oral or hybrid (oral+ written) exam. In the case of written and oral credit, the points are summed.
The passing threshold is 50% of the points.
Passing threshold: 50% of the points. Credit issues, based on which the questions are developed, will be sent to students by e-mail using the university e-mail system.
Laboratory: reports (Report) from thematically uniform blocks of laboratory exercises. Laboratory project carried out individually or in small groups Grade based on evaluation tailored to the project and dependent on the project's stage of progress at the time of evaluation.
Tutorials:
Performance of an independent or group project. The assignment requires the design and implementation of an embedded system or a part of it. Grade based on evaluation tailored to the project and dependent on the project's stage of progress at the time of evaluation.
For lecture, laboratory and project credits, the following percentage thresholds apply to individual grades: 2.0 (< 50%), 3.0 (50%-59%), 3.5 (60%-69%), 4.0 (70%-79%), 4.5 (80%-89%), 5.0 (90% and more)

Programme content

Embedded systems - introduction to the subject, historical outline, definitions of basic concepts. Controllers - construction, functionality, requirements for building controllers.Controllers programming methods.Embedded systems using FPGAs and ARM microcontrollers.Systems supporting programming and visualization.SoC systems.Sensors, detectors and complex measurement systems.Programmable digital circuits in embedded systems - areas of application.Processors in configurable and programmable systems. Embedded systems using FPGAs and ARM microcontrollers. Communication standards in embedded systems: internal and external, wired and wireless.

Course topics

Compatible with program content, including, but not limited to: Controllers - construction, functionality, requirements for building controllers.Controllers programming methods.Embedded systems using FPGAs and ARM microcontrollers.Systems supporting programming and visualization.SoC

systems.Sensors, detectors and complex measurement systems.Programmable digital circuits in embedded systems - areas of application.Processors in configurable and programmable systems. Embedded systems using FPGAs and ARM microcontrollers. Communication standards in embedded systems: internal and external, wired and wireless.

Teaching methods

Lecture: multimedia presentation with examples presented on the blackboard.
Laboratories: work on computers with software. Use of runner boards. Examples illustrated on screen/tablet
Project: work on computers with software, design of an embedded system or its component(s), discussion of identified problems, practical implementation of the designed system

Bibliography

Basic:
Crockett, L., Northcote, D., Ramsay, C., Robinson, F., & Stewart, R., Exploring Zynq MPSoC: With PYNQ and Machine Learning Applications, 2019, LIGHTNING SOURCE INC.
Urbaniak A., Podstawy automatyki, Wydawnictwo PP, Poznań 2004 (wydanie II)

Additional:
Sheng Ma, Libo Huang, Mingche Lai, Wei Shi, Zhiying Wang, Networks-on-Chip, 2014, Morgan Kaufmann.
Kasprzyk J. Programowanie Sterowników PLC, Warszawa 2007, WNT

Breakdown of average student's workload

	Hours	ECTS
Total workload	85	3,00
Classes requiring direct contact with the teacher	45	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	40	1,50