COURSE DESCRIPTION CARD - SYLLABUS

Course name

Signal processors and embedded systems

Course

Field of study

Electrical engineering

Year/Semester

1/2

Area of study (specialization)

Microprocessor Control Systems in Electrical Engineering

Profile of study

general academic

Level of study

Second-cycle studies

Course offered in

English

Form of study

full-time

Requirements

elective

Number of hours

Lecture

15

Laboratory classes

15

Other (e.g. online)

Tutorials

Projects/seminars

15

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

dr hab. inż. Michał Gwóźdź, prof. PP

email: Michal.Gwozdz@put.poznan.pl

Phone: 616652646

Faculty of Automatic Control, Robotics And
Electrical Engineering

Piotrowo 3A street, 60-965 Poznań

Responsible for the course/lecturer:

Prerequisites

Knowledge in the field of analog and digital electronics and the ability to design numerical algorithms and programming microprocessor systems at the level of first-cycle studies.

Course objective

Getting to know the architecture and applications of digital signal processors and embedded systems. Acquiring the ability to design real-time digital signal processing algorithms. Acquisition of programming skills for digital signal processors and microcontrollers with an ARM (Cortex) core - based on selected runtime environments.

Course-related learning outcomes

Knowledge

1. Has in-depth, structured and theoretical knowledge in the field of analysis of electrical circuits; has advanced knowledge of discrete circuits and methods of synthesizing electrical double points.

2. Has extended knowledge of high-level programming with the use of object-oriented programming elements.

3. Has in-depth knowledge of the construction and design of complex electrical systems, in particular measurement and control systems, knows the basic processes occurring in the life cycle of technical systems.

Skills

1. Is able design and manufacture electrical systems and systems for various applications.

2. Is able - when formulating and solving unusual engineering tasks and simple research problems - use a system approach, take into account non-technical aspects, use information and communication methods and tools.

Social competences

Recognizes the importance of knowledge in solving cognitive and practical problems and understands that in technology, knowledge and skills quickly become obsolete and therefore require constant replenishment.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture.

The knowledge acquired during the lecture is verified by a 45-minute test, carried out during the last lecture. The test consists of 7-10 questions, with different scores. Passing threshold: 50% of points. The final issues, on the basis of which the questions are developed, will be placed on the eCursy platform.

Design

1. Continuous assessment, rewarding the increase in the ability to use the learned rules and methods.

2. Assessment of knowledge and skills related to the implementation of the project.

Laboratory

1. Continuous assessment, rewarding the increase in the ability to use the learned rules and methods.

2. Assessment of knowledge and skills related to the exercise, assessment of the exercise report.

Common methods for projects and laboratories.

Obtaining additional points for activity during classes, especially for:

- proposing to discuss additional aspects of the issue,

- the effectiveness of applying the acquired knowledge while solving a given problem,

- the ability to cooperate as part of a team practically carrying out a detailed task in the laboratory,

- remarks related to the improvement of teaching materials.

Programme content

Types and division of digital signal processors (DSP). Architecture of signal processors, based on the Analog Devices Inc. family of floating point processors, ADSP-213XX. Fixed and floating point arithmetics. Designing digital filtering algorithms (FIR, IIR) and signal spectrum analysis (DFT, FFT). Cooperation of the signal processor with external systems. Characteristics of the instruction set. Characteristics of embedded systems. The architecture of the controllers with the ARM (Cortex) core. Peripheral blocks. Characteristics of the instruction set. Processor (controller) initialization process. Applications of DSP and ARM controllers for real-time signal processing. Structure of a microcomputer system. Selected design and development tools.

Teaching methods

1. Lecture with a multimedia presentation (diagrams, formulas, definitions, etc.) supplemented with the content given on the blackboard.

2. Projects and laboratory exercises: multimedia presentation, presentation illustrated with examples given on the blackboard and carrying out the tasks given by the teacher - practical exercises.

Bibliography

Basic

1. A. Dąbrowski, Przetwarzanie sygnałów przy użyciu procesorów sygnałowych, Wydawnictwo Politechniki Poznańskiej, Poznań, 2000.

2. R. G. Lyons, Wprowadzenie do cyfrowego przetwarzania sygnałów, Wyd. II, WKŁ, W-wa, 2010.

3. T.P. Zieliński, Cyfrowe przetwarzanie sygnałów. Od teorii do zastosowań, Wyd. II, WKŁ, W-wa, 2014.

4. S. R. Ball, “Embedded Microprocessor Systems: Real World Design”, Elsevier Science, 2002.

5. Technical documentation of DSPs and controllers with ARM (Cortex) core and their application notes and educational materials - available on the websites of Analog Devices Inc. and STMicroelectronics.

Additional

1. P. Barański, Przekształcenie Z. Zastosowania w filtracji cyfrowej sygnałów. Zbiór zadań., Wydawnictwo Politechniki Łódzkiej, 2014.

2. W. Kester, The Data Conversion Handbook, Elsevier, 2005.

3. An active power filter based on a hybrid converter topology – Part 1 / Michał Gwóźdź (WARiE), Łukasz Ciepliński (WARiE) // Bulletin of the Polish Academy of Sciences. Technical Sciences - 2021, vol. 69, no. 1, s. 1-10, URL: https://journals.pan.pl/dlibra/publication/136218/edition/119107/content

4. Application of a Tuned Inductor in a DC Power Supply with an Active Compensation Function / Łukasz Ciepliński (WARiE), Michał Gwóźdź (WARiE), Rafał M. Wojciechowski (WARiE) // Energies - 2022, vol. 15, iss. 17, s. 6108-1-6108-15, URL: https://www.mdpi.com/1996-1073/15/17/6108

Breakdown of average student's workload

	Hours	ECTS
Total workload	90	3,0
Classes requiring direct contact with the teacher	50	1,5
Student's own work (literature studies, preparation for laboratory classes, project preparation, preparation for tests) [1]	40	1,5

[1] delete or add other activities as appropriate