POZNAN UNIVERSITY OF TECHNOLOGY
EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)
pl. M. Skłodowskiej-Curie 5, 60-965 Poznań

COURSE DESCRIPTION CARD - SYLLABUS

Course name
Programming of signal processors

Course

Field of study
Automation and robotics

Year/Semester
2/3

Area of study (specialization)
Automation and robotics systems

Profile of study
general academic

Level of study
Second-cycle studies

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
12

Laboratory classes
12

Other (e.g. online)
-0

Tutorials
-0

Projects/seminars
-0

Number of credit points

2

Lecturers

Responsible for the course/lecturer:

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Faculty of Control, Robotics and Electrical Engineering

ul. Piotrowo 3A, 60-965 Poznań

Responsible for the course/lecturer:

Prerequisites

Knowledge: A student starting this subject should have basic knowledge of logic, digital circuits, microprocessor systems, the basics of signal theory.

Skills: Should have the ability to solve basic problems in the design of digital circuits, microprocessor programming and programming in C language as well as the ability to obtain information from specified sources. Should also understand the need to expand her/his competences and be ready to cooperate in a team.

Social competences: In addition, teh student should exhibit qualities such as honesty, responsibility, perseverance, cognitive curiosity, creativity, personal culture and respect for other people.

Course objective

1. Provide students with basic knowledge of programming signal processors in typical applications related to signal processing.

2. Developing students' problem-solving skills in the implementation of projects using signal processors.

3. Shaping students' teamwork skills.

Course-related learning outcomes

Knowledge

1. The student has specialized knowledge of remote and distributed systems, real-time systems and network techniques, - [K2_W3]

2. understands the design methodology for specialized analog and digital electronic systems, - [K2_W4]

3. has knowledge of adaptive systems, - [K2_W9]

Skills

1. The student is able to analyze and interpret the project technical documentation and to use scientific literature related to a given problem, - [K2_U2]

2. is able to select and integrate elements of a specialized measuring and control system including: control unit, executive system, measuring system as well as peripheral and communication modules - [K2_U13]

Social competences

1. The student is aware of the responsibility for own work and has willingness to comply with the principles of teamwork and taking responsibility for jointly implemented tasks. She or he can lead a team, set goals and define priorities leading to the task - [K2_K3]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Formative assessment:

a) in the scope of lectures:

based on answers to questions about the material discussed in previous lectures

b) in the scope of laboratories:

based on an assessment of the current progress of tasks implementation.

Summative assessment:

a) in the scope of lectures: the verification of the assumed learning outcomes is carried out by:

i. assessment of the knowledge and skills shown on the written test consisting of two parts - a set of open questions (the student cannot use didactic materials) and a set of problem tasks (the student may use didactic materials); a total of 20 points can be obtained; grading scale: 0 ... 10 points - unsatisfactory, 11 ... 12 points - satisfactory, 13 ... 14 points - sufficient plus, 15 ... 16 points - good, 17 ... 18 points - good plus, 19 ... 20 points - very good,

ii. discussion of the credit results,

b) in the field of laboratory, verification of the assumed learning outcomes is carried out by:

i. assessment of the student's preparation for individual classes,

ii. continuous assessment, during each class (oral answers) - rewarding the increase in the ability to use the learned rules and methods,

iii. assessment of knowledge and skills related to solving tasks through one test per semester,

iv. evaluation of reports prepared partially during the classes and also after their completion,

v. grading scale: 0 ... 50% of possible points - unsatisfactory, 51 ... 60% - satisfactory, 61 ... 70% - sufficient plus, 71 ... 80% - good, 81 ... 90% - a good plus, 91 ... 100% - very good.

Obtaining additional points for activity during classes, in particular for:

i. construction of an electronic module with a signal microprocessor and preparation of documentation

ii. effectiveness of applying the acquired knowledge while solving a given problem

iii. remarks related to the improvement of teaching materials.

Programme content

The lecture program includes the following topics:

1. Features and benefits of signal processors, requirements related to real-time processing, fixed and floating point processors, the use of superscalar architecture execution units, elements of the digital signal processing algorithms.

2. Structure of the signal processor, processing units, communication interfaces, examples of development modules.

3. IDE design environments for DSPs, project structure, basic configuration of the signal processor, definition of memory areas, configuration of the compilation process and debugging process using development platforms, CMSIS DSP library.

4. Implementation of finite impulse response (FIR) filters and adaptive filters.

5. Implementation of infinite impulse response (IIR) filters, generation and detection of tone signals, application of the Goertzel algorithm.

6. Implementation of Fast Fourier Transform (FFT) algorithms.

Laboratory classes are conducted in the form of six 2-hour exercises. Exercises are carried out by 2-person teams.

The program of laboratory classes covers the following topics:

1. Introduction to the integrated development environment

2. Support for GPIO and serial interfaces

3. A/D and D/A converters

4. Design and implementation of FIR digital filters

5. Design and implementation of IIR digital filters, analysis of DTMF tone signaling

6.Implemetation of Fast Fourier Transform (FFT) algorithms

Teaching methods

1. Lecture: multimedia presentation, simulations in the programming development

2. Laboratory classes: the use of modules with C5000, C6000, STM32F4xx, STM32F7xx signal processors.

Bibliography

Basic

1. Przetwarzanie sygnałów przy użyciu procesorów sygnałowych, Dąbrowski A. (red.), WPP, Poznań, 1997.

2. University Program educational materials for the signal processors of ARM and Texas Instruments, 2016.

3. Mikrokontrolery STM32 w systemach sterowania i regulacji, M. Szumski, BTC, 2018.

Additional

1. Digital signal processing using the ARM® CORTEX®-M4, Reay D. S., John Wiley & Sons, Inc., 2016

2. Digital signal processing and applications with the OMAP - L138 eXperimenter, Reay D., Wiley, 2012

3. Real-time digital signal processing from MATLAB to C with the TMS320C6x DSPs, 3e, Wright C.H.G., Morrow M.G., CRC Press, 2017

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2
Classes requiring direct contact with the teacher	25	1
Student's own work (literature studies, preparation for project classes, preparation for tests, project preparation) [1]	25	1

[1] delete or add other activities as appropriate