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
Digital signal processing

Course

Field of study	Year/Semester
Biomedical engineering	3/5
Area of study (specialization)	Profile of study
-	general academic
Level of study	Course offered in
First-cycle studies	Polish
Form of study	Requirements
full-time	compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
15	15	0
Tutorials	Projects/seminars	
0	0	

Number of credit points
2

Lecturers

Responsible for the course/lecturer:

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Faculty of Mechanical Engineering
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Responsible for the course/lecturer:

Prerequisites

Fundamentals of programming and measurements of physical quantities. Ability for self-learning and knowledge acquiring, basing on library (including e-resources) and Internet resources (e.g. Moodle and others).

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Course objective

Students receive theoretical knowledge and practical skills involving digital signal processing (including biomedical signals). Introduction to "VI techniques" - creation of the virtual measurement and analyzing systems. Inspiriting students to innovative solutions in the fields of digital signal processing (signal prametrization, signal anaysis and data visualisation).

Course-related learning outcomes

Knowledge

Student after completing the course has knowledge about digital signal processing: signal preconditioning, rules of digital to analogue and digital to analogue conversion, parameters of ADC conversion depending on types and features of signals, proper selection of signal acquisition devices. Student has knowledge about   measures and characteristics of signals in the amplitude, time and frequency domain; knows methods, procedures and algorithms to determine them. Student has the knowledge necessary to create the structures of signal processing systems (including parameterization, analysis and visualization of signals and results).

Skills

Student after completing the course knows how to configure the basic digital signal processing system including such elements as: acquisition, scaling, amplification, signal synthesis, filtration, decimation, triggering, determination of signal measures, averaging, visualization and data archiving. Student knows how to configure the structure of digital signal processing, which performs basic signal analysis in the time, amplitude and frequency domain. Student knows how to choose the type and parameters of time windows for various types of signal analysis and signal processing techniques. Student knows how to create a virtual measuring and analyzing device (virtual instrument) with a user interface including a control and visualization panel. Student knoes how to create an application that performs digital processing of the indicated biomedical signal.

Social competences

Student after completing the course is well aware of the necessity for continuous self-learning . Student is aware of the role of engineering activities in creating new innovative solutions in the field of biomedical engineering and the importance of these solutions in medical diagnostics and medical therapy. He knows how to think and act creatively and proactively.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Laboratory classes:

 Assessment - on the basis of the current progress of the tasks (programming).
Knowledge of theoretical issues necessary to develop the application.
Completeness and proper functioning of an application.
The final task: creating a virtual measuring system (proposed or based on your own idea) - optionally.

Lecture

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Written or on-line tests (via MOODLE platform): 10-20 issues covering the entire lecture material and issues indicated for own studies (self-studying).

Grading scale both laboratory and lecture (exam): below 60% unsatisfactory; 60-67% satisfactory, 68-74% satisfactory plus; 75-83% good; 84- 92% good plus; 93 -100% very good.

Programme content

Lectures:
Pre-processing and conditioning of an analogue signals. Fundamentals of the analogue to digital conversion and rules of signal acquisitions. Hardware: ADC and DAC converters, signal processors, serial and parallel interfaces (types, parameters, configuration). Digital signal processing of time series in the time, frequency and amplitude domains. Methods of time-frequency analysis. Data visualisation, data format conversion, data archiving. Software: the signal acquisition,   real-time analysis and control; structure of programming tools, modules description.

Laboratory classes:

The exercises in the computer laboratory exemplify the content of the lectures. Tasks carried out by students are related to the improvement of skills included in the course-related learning outcomes. These tasks also include: individual programming and creating fragments of a digital signal processing system using the graphical programming environment ("G" language). The final result is the creation of an application - a virtual measurement and analysis system (real-time system) including the user interface (GUI).

Teaching methods

Lecture - multimedia presentations. The content of the lectures is made available in electronic form before the start of classes, which allows comfortable and active participation in the lectures.

The laboratories take place in the Digital Signal Processing lab equipped with workstations and RTA (Real Time Analysis) programming environment. Optionally, remote work is possible.

The subject is comprehensively supported on the Moodle e-learning platform. There are available resources such as: lecture materials, multimedia, source materials (selected publications, technical notes), instructions for laboratory exercises, report templates, sample reports. It is also possible to perform exercises remotely based on tutorials and individual data sets.

Bibliography

Basic
1. Zieliński T. Cyfrowe przetwarzanie sygnałów. Od teorii do zastosowań, WKŁ, Warszawa 2005
2. Marven C., Ewers G., A simple approach to digital signal processing, Wiley 1996.
3. Braun S., Discover signal processing, Wiley 2008.

Additional
1. Moczko J Kramer L, Cyfrowe metody przetwarzania sygnałów biomedycznych, Wydawnictwo

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Naukowe UAM, Poznań 2001.

2. Qian S., Chen D., Joint Time-Frequency analysis, methods and applications, Prentice Hall PTR Asimon &Schuster Company, 1996.

3. DASYLab - Data Acquisition System Laboratory - User Guide, DASYTEC USA 1996.

4. Supplementary materials available on the MOODLE e-learning platform.

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,0
Classes requiring direct contact with the teacher	30	1,0
Student's own work (literature studies, self-education based on e-learning resources, preparation for laboratory classes, reports, preparation for tests/exam) [1]	20	1,0

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[1] delete or add other activities as appropriate