# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Foundations of digital signal processing [N1EiT1>PCPS]

## Course

Field of study
Electronics and Telecommunications

Year/Semester
2/4

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

## Number of hours

Lecture
20

Laboratory classes
20

Other
0

Tutorials
0

Projects/seminars
0

## Number of credit points

6,00

## Coordinators

dr hab. inż. Anna Domańska
anna.domanska@put.poznan.pl

## Lecturers

dr hab. inż. Anna Domańska
anna.domanska@put.poznan.pl

## Prerequisites

Knowledge about basic terms from the mathematical analysis and linear algebra, knowledge about signal processing (analog): basic terms, definition and properties of Fourier and Laplace transforms, Fourier series, design of analog filters.

## Course objective

Knowledge and understanding of basic methods of discrete signals analysis, knowledge how to analyse and design digital linear time-invariant systems.

## Course-related learning outcomes

Knowledge:
1. Knowledge about fundamental tools for analysis of digital signals and systems (z-transform, and Fourier transform)
2. Knowledge about basic tools for practical signal spectrum analysis
3. Knowledge about design and implementation of digital linear time-invariant filters

Skills:

1. Ability to correct interpretation of digital signal or system analysis results
2. Ability to design and implement a linear time-invariant digital filter
3. Ability to do spectrum analysis of a signal

Social competences:
1. Understanding necessity and knowledge about continuous learning, improving professional, personal and social competences
2. Understanding of necessity of professional approach to technical problems, and responsibility for his/her technical solutions

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture - written exam on which consist several equivalent questions problem-oriented. Passing threshold: 50% points, linear scale.

Laboratory:
- positive evaluations for individually prepared reports to every exercise
- positive evaluations of the knowledge from themes of exercises (verification oral or written)

## Programme content

Lecture
1. Processes of the digitalisation (sampling, quantisation) of signals.
2. Theory of discreet linear time-invariant systems (LTI).
3. Z-transform, definition and properties.
4. Fourier transform of discrete-time signals (DtFT), selected properties of the transform.
5. Discrete Fourier transform (DFT), selected properties, frequency analysis of signals, leakage of spectrum.
6. Coherent and incoherent averaging multiple DFT.
7. Digital filters FIR and IIR: algorithm, structure, design.
9. Comb filter, notch filter.
9. Digital resonator, digital oscillator.
10. Moving average filter (MAV).
11. Coherent signal averaging, CAV filter.

Laboratory
Exercises concern of selected issues presented on the lecture (realized in Matlab programs): application of Z Transform (transfer function realization), DFT (properties, frequency analysis, leakage of spectrum), averaging multiple DFT, digital filters (FIR, IIR, comb, notch), digital resonator/oscillator, MAV, CAV.

## Course topics

none

## Teaching methods

Lecture - presentation inclusive examples to chosen issues.

Laboratory – exercises based on Matlab and Simulink programs.
Before every exercise
- presentation explaining theoretical context concerning of theme and of task to realization,
- the presentation of part of program code Matlab (rest of code is supplemented by students).

## Bibliography

Basic
1. Zieliński T., Cyfrowe przetwarzanie sygnałów. Od teorii do zastosowań, WKŁ, Warszawa, 2009.
2. Lyons R., Wprowadzenie do cyfrowego przetwarzania sygnałów, WKŁ, Warszawa, 2010.
3. Wojciechowski J., Sygnały i systemy, WKŁ, Warszawa, 2008.

Additional
1. Mrozek B., Mrozek Z., Matlab i Simulink. Poradnik użytkownika, Helion, Gliwice, 2018.
2. Osowski S., Cyfrowe przetwarzanie sygnałów z zastosowaniem MATLABA, OWPW, Warszawa, 2016.
3. Zieliński T. (red), Cyfrowe przetwarzanie sygnałów w telekomunikacji. Podstawy. Multimedia. Transmisja, PWN, Warszawa, 2014

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 125 | 6,00 |
| Classes requiring direct contact with the teacher | 50 | 2,00 |
| Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation) | 75 | 4,00 |