COURSE DESCRIPTION CARD - SYLLABUS

Course name
System theory

Course

Field of study	Year/Semester
Electronics and Telecommunications	2/3
Area of study (specialization)	Profile of study
	general academic
Level of study	Course offered in
First-cycle studies	english
Form of study	Requirements
full-time	compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
30	15	
Tutorials	Projects/seminars	
0	0	

Number of credit points

4

Lecturers

Responsible for the course/lecturer:
dr inż. Damian Karwowski
damian.karwowski@put.poznan.pl

Responsible for the course/lecturer:

Prerequisites

Student has a systematic knowledge of mathematical analysis, algebra and theory of probability and physics. Student has a systematic knowledge, together with necessary mathematical background, of 1D signal theory. This knowledge allows him/her to understand the representation of signals and signal analysis in time domain and frequency domain.

Course objective

The aim of the course is to present the theory of continuous linear systems, and a description of these systems in the domain of Fourier transform, Laplace transform, and the state space representation. There are presented issues that are related to systems stability and minimal phase systems (according to selected criteria), as well as issues of automatic control systems. The student becomes familiar with issue of the design of filters and their synthesis. There are presented aspects of nonlinear systems, the base of deterministic chaos and artificial neural networks.

Course-related learning outcomes

Knowledge

1. Student has a detailed, systematic knowledge of the linear systems description in the domain of transforms (Fourier, Laplace) and in the state space. Has knowledge in systems stability and minimal phase, according to selected criteria.

2. Student has basic knowledge in automatic control systems and descrete systems.

3. Has knowledge in designing and synthesizing of filters with the use of known methods.

4. Has basic knowledge on nonlinear systems, knows the theory and issues connected with artificial neural networks.

Skills

1. Student is able to describe an electronic system in the state space.

2. Student can describe, basing on a defined problem, the filter parameters, design such a filter and synthesize it.

3. At basic level student can design and teach an artificial neural network to solve a technical problem.

Social competences

1. Student is open and understands the need of constant learning and improving her/his professional qualifications.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

1. Lecture

Written and / or oral exam. The exam consists of a few to over a dozen questions (depending on the assumed nature of the questions) and concerns the content presented during the lectures. The exact nature of the exam questions will be presented to students during one of the last lectures. Pass threshold: 50% of points.

2. Laboratory classes

Test at the end of the semester and/or series of smaller tests during the semester. The tests consists of several questions checking skills in the area of system theory learned. Passing threshold: 50% of points.

Programme content

1. Lecture

The base of continuous linear systems. Transmission of signals through linear systems. Stability of systems and minimal-phase systems.

State space description of ystems. Relationship between state space description and the transmittance.

Signal flow graphs. Description of systems with a flow graph.

Automatic control systems. Efficiency analysis of a selected types of control units.

Discrete signals and systems.

Introduction to filter design. Selected approximations of filter frequency characteristics. Basis aspects of filter synthesis.

Nonlinear systems. Pointing out the main differences in behaviour of linear and non-linear systems.

Deterministic chaos. Artificial neural networks.

2. Laboratory classes

Introduction to Matlab.

Complex Fourier series.

Transmittance and frequency characteristics of systems. Poles and zeros of the transmittance. Impact of the poles localization on the impulse response of systems.

Stability of systems and minimal-phase systems.

Automatic control systems.

State space description.

Discrete signals and systems.

Analog filters. Artificial neural networks.

Teaching methods

1. Lecture

Classes with clear elements of traditional lecture and problem lecture (discussion with students of a specific problem), depending on the content of the presented material. Presentation of the theory and methods with examples of their use. Selected contents of the lecture are presented on a multimedia projector or board. The discussion of the issues is accompanied by information on their practical application.

2. Laboratory classes

Solving problems given by the teacher. Interpretation of the received solution and formulation of conclusions. Discussion of the practical application of the methods/algorithms being the subject of laboratory classes.

Bibliography

Basic

1. A. V. Oppenheim, A. S. Willsky, S. Hamid, Signals and systems (2nd Edition), 1996.

Additional

1. Chi-Tsong Chen, Signals and Systems, 2004.

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,0
Classes requiring direct contact with the teacher	58	2,0
Student's own work (literature studies, preparation for laboratory classes, preparation for tests/exam) [1]	42	2,0

[1] delete or add other activities as appropriate