COURSE DESCRIPTION CARD - SYLLABUS

Course name
System theory [S1EiT1>TSYST]

Course

Field of study
Electronics and Telecommunications

Year/Semester
2/3

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
30

Other (e.g. online)
0

Tutorials
15

Projects/seminars
0

Number of credit points

6,00

Coordinators

dr hab. inż. Damian Karwowski
damian.karwowski@put.poznan.pl

Lecturers

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. The student knows and understands the basic concepts and methods of description of linear and non

linear electronic systems, automatic control systems and telecommunications systems.
2. Has knowledge of simulation methods, implementation of simulation experiments allowing to evaluate the parameters of a simulated circuit or system.

Skills:
1. The student is able to use catalogs, search for the necessary information from electronic circuit application notes and select the appropriate electronic components and systems. Can identify the problem and formulate a design specification for a simple analog electronic circuit. He can design and implement a simple analog electronic circuit.
2. Can implement basic computational algorithms that relate to selected problems in the area of systems theory, using popular programming languages (eg Matlab, C).
3. Can obtain information from literature, databases and other sources in Polish or English; is able to integrate the obtained information, interpret it, draw conclusions and justify opinions.

Social competences:
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:

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.
3. Tutorials
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 systems. 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.
3. Tutorials
Frequency characteristics of linear systems, analysis of 2nd order systems.
Stability and minimal phase of the systems.

Description of systems in the state space.
Signal flow graphs. Description of systems using graphs.
Approximation of the frequency characteristics of filters.

Course topics

none

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.
3. Tutorials
Auditorium exercises. Solving the tasks given by the teacher. Interpretation of the obtained solution and formulation of conclusions. Discussion of the possible practical application of the issues being the subject of the exercises.

Bibliography

Basic
1. T. Kaczorek: Teoria sterowania i systemów, PWN, Warszawa 1993.
2. Papoulis, Obwody i układy, WKiŁ, Warszawa 1988.
3. Jacek Wojciechowski, Sygnały i Systemy, WKiŁ, Warszawa, 2008.
4. K. Snopek, J. Wojciechowski, Sygnały i systemy - zbiór zadań, Wyd. Politechniki Warszawskiej, 2010.
Additional
1. J. Klamka, Z. Ogonowski: Teoria systemów liniowych, Wyd. Politechniki Śląskiej 1999.
2. J. Kudrewicz, Fraktale i chaos, WNT, Warszawa 1993.
3. S. Osowski, Sieci neuronowe w ujeciu algorytmicznym, WNT, w. 2, Warszawa 1996.
4. J. Izydorczyk, J. Konopacki, Filtry analogowe i cyfrowe, Polska Akademia Nauk, Oddział w Katowicach, Katowice 2003.
5. Praca zbiorowa pod redakcja G.C.Temesa i S.K. Mitry, Teoria i projektowanie filtrów, WNT, Warszawa 1978.
6. S. Osowski, Sieci neuronowe do przetwarzania informacji, Oficyna Wyd. Pol. Warszawskiej 2000.

Breakdown of average student's workload

	Hours	ECTS
Total workload	150	6,00
Classes requiring direct contact with the teacher	90	3,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	60	3,00