Subject code	Credits
INF3023	4

Title

SKAITMENINIAI SIGNALAI IR GRANDINĖS

Title in English

DIGITAL SIGNALS AND CIRCUITS

Subject goal and annotation

This course is an introduction to digital circuits and digital signals, analog-to-digital and digital-to-analog conversion, analysis of digital signals, signal modulation and demodulation, digital signal multiplexing and demultiplexing, digital filtering, combinational logic circuits and programmable logic elements

Prerequisites

Undergraduate courses: MAT1001 Mathematics, FIZ1016 General Physics, INF1006 Discrete Structures and Mathematical Logic, MAT2014 Numerical Methods, INF3029 Computer Architecture and Operating Systems

Relationship between the learning outcomes of the Programme and learning outcomes of the subject

Learning outcomes of the Programme	Learning outcomes of the subject	Criteria for measuring the achievement of learning outcomes
1 Knowledge and understanding of basic mathematics, physics and nature, and its applicability in engineering.	Knowledge and understanding oforigin of the signal, signal types, mathematics and statistics method of signal analysis and processing.	Student demonstrates knowledge of signal processing methods and techniques; demonstrates the ability to apply signals processing methods for the practical use.
3. Knowledge of basic and advanced computer science and its application.	Knowledge and understanding of digital signals modeling, analysis and processing.	Student demonstrates skills in using Python, SciPy software packages in modeling, analyzing and processing digital signals
4. Knowledge of basic and advanced multimedia theories and applications, ability to apply it. 9. Perform interdisciplinary research and development/creation in multimedia area, apply results in practical applications.	Knowledge and understanding of digital signals theory for multimedia content analisis and processing.	Student demonstrates skills in software development using Python, SciPy packages for analyzing and processing multimedia content as digital signals
11. Analysis, design and development of advanced Multimedia systems. 12. Analysis, design and development of diverse software systems.	Knowledge and understanding of digital signals theory and logical elements for multimedia and other software system creation..	Student demonstrates skills in software development using Python, SciPy packages for analyzing and processing multimedia content as digital signals

Subject content

	Lecture topics and contents	Hours
1.	Signal types and transformations	2
2.	Signal classification. Signal energy and power. Elementary signals	2
3.	Signal spectrum. Fourier transform	2
4.	Linear system analysis	2
5.	Random signal models	2
6.	Signal digitization. Sample theorem	2
7.	Discrete signal models. Digital Fourier transform. Z transform.	2
8.	Stationary linear discrete systems	2
9	Fast Fourier transform. Digital filtering	2
10.	Digital filter design	2
11.	Elements of Boolean algebra	2
12.	Logic gates and combinational circuits	2
13.	Combinational circuit minimization	2
14.	Sequential logic. Finite automata. Triggers. Registers	2
15.	Programmable logic devices	2
	Total	**30**

Practical work contents

Three groups of practical problems. All problems should be described, solved and presented.
1. Modelling and representation of signals. Signal statistical characteristics estimation using WinPython and NumPy tools.
2. Digital signal Fourier transform and spectrum calculations. Digital filter design and testing.
3. Circuit design. Register simulation.

Evaluation of study results

Final written exam (50%), mid-term written exam (17%), and assessments of laboratory (practical) work (33%).

Distribution of subject study hours

Lectures	30
Laboratory work	30
Individual studies (including studies in groups, preparation for the mid-term and final exams)	44
Total	**104**

Recommended literature

No	Authors and title of a publication	Number of copies available		
		in the Library of VMU	*in specialized publication collections at VMU*	*in other libraries (in the Library of Kaunas University of Technology)*
Main literature				
1.	Krivickas R. Skaitmeninis signalÔapdorojimas (Digital Signal Processing). Vilnius, Mokslas, 1984.		2	50
2.	Proakis J.G, Manoakis D.G. Digital Signal Processing: Principles, Algorithms, and Applications. Fourth Edition. Prentice-Hall, Inc.,		1	10

	2007			
3.	Kanapeckas P., Kazanaviļius E., Mikuckas A. KompiuteriÔelementai (Computer Elements). Kaunas, Technologija, 2008.		3	60
4.	Navakauskas D. Skaitmeninis signalÔ apdorojimas taikant MATLAB (Digital Signal Processing Using MATLAB). Vilnius, Technika, 2008.	1	1	25
Supplementary literature				
1.	Kuphaldt T.R. All About Circuits, *http://www.allaboutcircuits.com* , 2012.	Available on the internet		
2.	Cuthbert T.R. Circuit Design Using Personal Computers. Willey & Sons, 1989.	1		
3.	Ļitaviļius A. Skaitmeninis telekomunikacijÔ signalÔapdorojimas (Digital Processing of Telecommunications Signals). Kaunas, Technologija, 2008.	25		

Subject prepared and coordinated by

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