RTU Course "Digital Signal Processing"

33000 Faculty of Computer Science, Information Technology and Energy

General data

Code	DE0493
Course title	Digital Signal Processing
Course status in the programme	Compulsory/Courses of Limited Choice
Responsible instructor	Anna Litviņenko
Academic staff	Deniss Kolosovs
Volume of the course: parts and credits points	1 part, 3.0 credits
Language of instruction	LV, EN
Annotation	Within the framework of the course the following topics are covered: sampling theorem; signal conversion from an analogue to a digital form without aliasing; interrelation between frequency response, impulse response and difference equation; implementation of finite and infinite impulse response filters by means of signal processors; orthogonal and non-orthogonal digital transformations; impact of quantization errors on signal representation quality.
Goals and objectives of the course in terms of competences and skills	The goal of the course: to acquire basic knowledge about the sampling theorem and signal conversion from an analogue to a digital form without aliasing. The objectives are the following: to develop skills that are essential to choose sampling and quantization parameters of continuous signals; to enable students to use interrelation between frequency response, impulse response and difference equation in order to design finite and infinite impulse response filters; to improve the students' ability to evaluate the impact of digital transformations and quantization errors on signal representation quality.
Structure and tasks of independent studies	Students have to solve filter modeling problems in MatLab/ Simulink/ SystemView/ LabView environments independently in preparation for tests, practical classes, exam.
Recommended literature	Obligātā/Obligatory Michael Parker. Digital Signal Processing 101: Everything You Need to Know to Get Started . Newnes; 2nd edition. 2017. (432) Balodis G. Diskrētā signālu apstrāde Rīga, RTU izdevniecība, 2011 - 130 lpp. Beķeris E. Signālu teorijas pamati. Rīga, RTU izdevniecība, 2010 - 229 lpp. Stearns S. D. Digital Signal Processing with Examples in Matlab CRC Press, 2003, 336 p. Papildu/Additional Lynn P., Fuerst W. Introductory Digital Signal Processing With Computer Applications. John Willey and Sons, 2000 - 479 p. Mitra S., Kaiser J. Handbook for Digital Signal Processing. John Willey and Sons, 1993 - 1268 p. Wanhammar L. DSP Integrated Circuits. Academic Press, 1999 – 561 p. Айфичер Э., Джервис Б. Цифровая обработка сигналов М., Вильямс, 2004 – 992 с.
Course prerequisites	Basic computer skills; theory of complex variable; relations between contiguous and digital signals and their spectra; application of logical and numerical functions; fixed- and floating-point arithmetic.

Course contents

Content	Full- and part-time intramural studies		Part time extramural studies	
	Contact Hours	Indep. work	Contact Hours	Indep. work
Linear time-invariant two-port characteristics	4	6	1	6
Analogue filter design	4	6	1	6
Continuous signal conversion into a digital form	2	3	1	3
Design and implementation of finite and infinite impulse response filters	6	9	1	9
Fourier transform and other digital transformations	6	9	1	9
Sampling frequency conversion	2	3	1	3
Impact of quantization and sampling errors	4	6	1	6
Non-uniform sampling characteristics	4	6	1	6
Total:	32	48	8	48

Learning outcomes and assessment

Learning outcomes	Assessment methods
Implementation of finite and infinite impulse response filters based on frequency response. Simulation of digital filters in MatLab environment.	Tests, Reports, Exam
Implementation of finite and infinite impulse response filters based on impulse response. Simulation of digital filters in MatLab environment.	Tests, Reports, Exam
Implementation of finite and infinite impulse response filters based on difference equation. Simulation of digital filters in MatLab environment.	Tests, Reports, Exam

Implementation of finite and infinite impulse response filters based on canonical, cascade and parallel structures. Simulation of digital filters in LabView environment.	Tests, Reports, Exam

Evaluation criteria of study results

Criterion	%
Tests	20
Reports and their defence	30
Exam	50
Total:	100

Study subject structure

Part	CP	Hours			Tests		
		Lectures	Practical	Lab.	Test	Exam	Work
1.	3.0	20.0	20.0	0.0		*	