RTU Course "Telecommunications Theory"

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General data

Code	RDE707
Course title	Telecommunications Theory
Course status in the programme	Compulsory/Courses of Limited Choice
Responsible instructor	Inna Kurbatska
Academic staff	Vjačeslavs Bobrovs Andris Ozols Rihards Mūrnieks Elans Grabs
Volume of the course: parts and credits points	1 part, 6.0 Credit Points, 9.0 ECTS credits
Language of instruction	LV, EN
Annotation	A communication system is the chain of elements allowing to transmit a message from the source to the recipient. The study course focuses on the most crucial elements, processing methods, and rules that influence the performance of communication systems. Telecommunications Theory provides a fundamental knowledge base for telecommunications engineers to understand communication systems, the principal elements, and the advantages or disadvantages. By taking the course, students will have a fundamental understanding of the following things: general information of a communication system; mathematical models of signals, noises, and messages; continuous and discrete signal models; random processes; digital filtration; theoretical evaluation of modulation, transmission, and detection.
Goals and objectives of the course in terms of competences and skills	The aim of the study course is to provide and develop basic knowledge about the principles of the main working principles, the structure, and mathematical analyses methods. The tasks of the study course: 1. To acquaint with the general structure of communication systems, principles of operation and signal transmission. 2. Explain signal behaviour in communication system elements. 3. Analyse signals, modulation methods, and their performance, noisy channel operation, interfering signal effects. 4. To develop the ability to perform analysis and synthesis of communication systems at the block level, using analytical and numerical methods.
Structure and tasks of independent studies	Independent work will be organized in the form of individual work, where students will have to solve the tasks set by the lecturer, using the knowledge gained in lectures, performing independent study and research of scientific literature, doing the analysis of results obtained in laboratory works, practical and course work realization. Independent preparation for tests and exams regarding specific study course topics.
Recommended literature	Obligātā/Obligatory: 1.Beķeris E. Signālu teorijas elementi. Rīga, RTU, 2001, 200 lpp. 2.R. G. Gallager. “Principles of Digital Communication”, Cambridge University Press, 2008. – 423 p. 3.S. O. Agbo. “Principles of Modern Communication Systems”, Cambridge University Press, 2017. – 442 p. 4.R. E. Ziemer, W. H. Tranter. „Principles of Communications, 7th Edition: Systems, Modulation, and Noise” Wiley & Sons, 2014. – 760 p. 5.G. Vasilescu. “Electronic Noise and Interfering Signals”, Springer, 2005. – 709 p. 6.D. J. C. Mackay. “Information Theory, Interference, and Learning Algorithms”, Cambridge University Press, 2006. – 628 p. 7.M. E. Frerking. “Digital Signal Processing in Communication Systems”, Springer, 1994. – 640 p. 8.J. R. Barry, E. A. Lee, D. G. Messerschmitt. “Digital Communication“, Springer, 2004. – 855 p. Papildu/Additional: 1.1. J. G. Proakis, M. S. Salehi. “Fundamentals of Communication Systems, 2nd Edition”, Pearson, 2014. – 928 p. 2.B. Sklar. “Digital Communication: Fundamentals and Applications” Prentice Hall, 2017. – 1104 p. 3.D. L. Ruyet, M. Pischella. „Digital Communications 1: Source and Channel Coding” Wiley, 2015 – 392 p. Kursa apguvē var izmantot arī interneta resursus / Internet resource can also be used to acquire the course: 1.https://rintintin.colorado.edu/~gifford/5830-AWL/Anritsu%20Eye%20Diagram.pdf 2. https://www.ijemr.net/DOC/StudyOfDifferentTypesOfNoiseAndItsEffectsInCommunicationSystems(410-413).pdf
Course prerequisites	Physics, Mathematical Analysis, Theory of Fourier’s Series and Integrals, Theory of Probability, Fundamentals of Signal Theory, Linear Circuit Theory, Matlab, Mathcad.

Course contents

Content	Full- and part-time intramural studies	Part time extramural studies

	Contact Hours	Indep. work	Contact Hours	Indep. work
Introduction. Telecommunications theory course motivation, goal and contents. Main definitions.	3	2	0	0
Structure of communication systems, parameters, history.	3	2	0	0
Random processes and their characteristics.	3	2	0	0
Spectrum of random process.	3	2	0	0
Complex form of a signal.	3	2	0	0
Nyquist sampling theory and mathematical representation of signals.	3	2	0	0
Modulation of harmonic signals.	3	2	0	0
Modulation of impulse and noisy signals.	3	2	0	0
Deterministic communication channels.	3	2	0	0
Stochastic communication channels.	6	4	0	0
Information theory.	6	4	0	0
Noise free channel capacity.	3	2	0	0
Noisy channel capacity.	3	2	0	0
Line codes and their classification.	3	2	0	0
Main error correction codes and their classification.	3	2	0	0
Shannon theory and non-stationary channels.	3	2	0	0
Received signal processing methods.	3	2	0	0
Signal filtration theory.	3	2	0	0
Fundamentals of noise-resistant theory.	3	2	0	0
Optimal receivers.	6	4	0	0
Optimal reception of continuous signals.	3	2	0	0
Laboratory and practical tasks.	48	72	0	0
Total:	120	120	0	0

Learning outcomes and assessment

Learning outcomes	Assessment methods
Is be able to understand communication systems and questions regarding those (especially question regarding Information theory), as well as new research in communication elements.	Tests, practical works, exam. Criteria: the capability to freely understand different communication questions.
Is able to understand communication systems terminology.	Tests, practical works, exam. Criteria: the capability to freely understand communication terminology.
Is able to define other science (physics, different engineering, social, etc.) and practical problems (for instance, technical and social relations) in terms of communication theory.	Tests, practical works, exam. Criteria: the capability to creatively apply the knowledge of telecommunication theory.
Is able to quantitatively analyze communication systems and a combination of systems.	Tests, practical work, laboratory work, exam. Criteria: the capability to perform analytical and numerical calculations.

Evaluation criteria of study results

Criterion	%
Tests	60
Laboratory works and practical tasks	20
Exam	20
Total:	100

Study subject structure

Part	CP	Hours per Week			Tests		
		Lectures	Practical	Lab.	Test	Exam	Work
1.	6.0	2.0	2.0	2.0		*	