RTU Course "Transmission Systems"

13105 null

General data

Code	RDE706
Course title	Transmission Systems
Course status in the programme	Compulsory/Courses of Limited Choice
Responsible instructor	Rolands Parts
Academic staff	Vjačeslavs Bobrovs Jānis Braunfelds Rihards Mūrnieks
Volume of the course: parts and credits points	1 part, 6.0 Credit Points, 9.0 ECTS credits
Language of instruction	LV, EN
Annotation	The study course deals with transmission systems (TS), their evolution and application in modern telecommunications networks. Topics include signal digitalisation and transmission, regeneration of a digital signal and its conversion back to the analogue form. Formation and multiplexing of digital streams, as well as network synchronisation are examined. The study course covers the theory of TS, as well as practical measurements in the laboratory. International standards related to TS interfaces are considered. Students are prepared for professional career and further studies at the Master's level.
Goals and objectives of the course in terms of competences and skills	The aim of the study course is to provide and introduce theoretical knowledge about transmission systems (TS) and to develop practical skills in performing calculations for TS design. Tasks of the study course: • to provide basic knowledge of transmission systems; • to explain the general principles of operation of transmission systems; • to develop skills to perform TS measurements and competently evaluate their results, draw conclusions; • to explain the application of PS in telecommunication networks, showing their significance in solving various technical problems.
Structure and tasks of independent studies	Independent work is organized as the study of educational literature, solving practical problems, and developing a course project. Preparation of a theoretical basis for each laboratory work, processing of laboratory work results, and preparation of a report.
Recommended literature	Obligātā/Obligatory: 1.Kameron Smith, Telecommunications Essentials, 2019 – 233 p. 2.Annabel Dodd, Essential Guide to Telecommunications, 2019 – 672 p. 3.Jeba Peace, Jesie Eunice, Telecom Basics for Beginners, 2019 – 30 p. 4.Samson Colon, Wireless Networks and Communications, 2019 – 229 p. 5.Toni Janevski, QoS for Fixed and Mobile Ultra-Broadband, 2019 – 344 p. 6.Eric Coll, Telecom 101, Reference Book, Fifth Edition, 2020 – 550 p. 7.Harry Newton, Steven Schoen, Newton's Telecom Dictionary, 2018 – 1450 p. Papildu/Additional: 1.Ian A. Glover, Peter M. Grant, Digital Communications, 3. eddition, 2009 – 1024 p. 2.B. Sklar, Digital Communication: Fundamentals and Applications, 2. Edition, 2017 – 1104 p. 3.John. G. Proakis, Contemporary Communication Systems using MATLAB,3rd Edition, 2012, 640 p.
Course prerequisites	Signal theory, telecommunication theory, electrical measurements.

Course contents

Content	Full- and part-time intramural studies		Part time extramural studies	
	Contact Hours	Indep. work	Contact Hours	Indep. work
Evolution of transmission systems. (TS) Analogue and digital TS. Amplification and regeneration of signals.	4	4	0	0
Analysis of signals to be transmitted. Formulation of specifications for TS. Examples.	8	8	0	0
Separation methods of transmission directions used in TS.	6	6	0	0
Hybrid circuit, its principles, implementation and application, similar circuits.	6	6	0	0
Sampling and quantising of analogue signals for transmission in digital TS (source encoding).	4	4	0	0
Uniform and non-uniform quantisation. Principles and implementation.	4	4	0	0
Quantisation noise, its analysis for different encoding types.	8	8	0	0
Vocoders, speech transmission over LTE and 5G, EVS.	4	4	0	0
Design of E1 primary group (30 channels). T1 systems. Relevant ITU Recommendations.	4	4	0	0
Versions of E1 architecture.	4	4	0	0
Statistical analysis of signals, random processes.	4	4	0	0
Digital transmission over noisy environment. Probability of transmisson error.	4	4	0	0
Receivers for digital signāls, design principles. Functional units and components.	4	4	0	0

Multiplexing of primary (E1) channel groups.	4	4	0	0
Plesiochronous digital hierarchy (PDH).	4	4	0	0
Synchronous digital hierarchy (SDH, OTN).	4	4	0	0
Synchronisation of transmission networks.	4	4	0	0
Primary reference clocks (PRC).	4	4	0	0
Further development of transmission systems. Reliability.	4	4	0	0
Course project (Simulation of TS using MATLAB environment).	32	32	0	0
Total:	120	120	0	0

Learning outcomes and assessment

Learning outcomes	Assessment methods
Is able to independently orientate in teaching and scientific literature in the field of transmission systems. Discussions in practical and laboratory work, reports.	Tests and exam.
Is able to identify, analyse and classify the main techniques of creating transmission systems according to the requirements of use and services.	Tests and exam.
Is able to independently perform experiments - measurements in the field of transmission systems, is able to process and analyse experiment results.	Laboratory works report.
Is able to independently develop transmission systems in a MATLAB environment.	Course project.
Is able to demonstrate the basic theory of transmission systems (TS), to recognize the importance of TS in telecommunications networks.	Tests and exam.

Evaluation criteria of study results

Criterion	%
Tests	40
Laboratory works	20
Course project	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		*	