RTU Course "Telecommunications and Data Networks"

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General data

Code	RAE603
Course title	Telecommunications and Data Networks
Course status in the programme	Compulsory/Courses of Limited Choice
Responsible instructor	Jurģis Poriņš
Volume of the course: parts and credits points	1 part, 5.0 Credit Points, 7.5 ECTS credits
Language of instruction	LV, EN
Annotation	This course covers advanced network architecture based on hybrid network technologies – voice, data, Voice over Internet Protocol, and wireless networking. Particular emphasis will be placed on network analysis including network component testing, end-to-end testing, component isolation, network repair and design review.
Goals and objectives of the course in terms of competences and skills	1. This course constitutes an important background element for researchers planning to develop further competence in edge networking topics. 2.The course aims at fostering students' initiative, promoting their understanding of innovations and developing students' skills of self-criticism in the communications area, as well as developing their ability to carry out fundamental scientific research on an individual basis. 3. Students are enabled to promote their knowledge of multiservice networks; this course provides the students with appropriate theoretical and practical skills in the area. 4. . Students are enabled to develop their understanding of mobile network technologies as the ba
Structure and tasks of independent studies	The teaching methodology will consist of three distinct parts. 1. Interactive lecture. This methodology is aimed at fostering active learning by the students by inviting their involvement in the teaching activities where they can discuss specific issues related to the topics presented by the teacher. 2. Individual Research. Based on such research, the students will prepare presentations. 3. Discussion (seminars). Based on the individual presentation, the teacher and the students will discuss the corresponding research topics and ask questions to the classmates. Paper evaluations that demand critical reasoning will be a part of the grade.
Recommended literature	1.Gebali, Fayez. Analysis of Computer and Communication Networks. 2008, XXXII, 669 p. 187 illus. ISBN: 978-0-387-74436-0 2.William Stallings. Data and Computer Communications. 9th ed. Pearson Custom Computer Science, 2010, 578 p. 3.Pierre Bremaud, Markov Chains. Gibbs Fields, Monte Carlo Simulation, and Queues. 2010, 434 p. 4.Gunter Bolch, Stefan Greiner, Hermann de Meer, Kishor Shridharbhai Trivedi. Queueing Networks and Markov Chains: Modeling and Performance Evaluation with Computer Science Applications. 2010. 5.Kavacis A, Lauks G. Daudzprotokolu iezīmju komutēšana MPLS. Rīga: RTU, 2008. 6.Scott F. Midkiff. Network Performance, Design, and Management. Bradley Department of Electrical and Computer Engineering, Virginia Polytechnic Institute and State University, 2006. 7.William J. Stewart. Probability, Markov chains, queues, and simulation. 2009. 758 p.
Course prerequisites	Good knowledge of networking concepts and protocols

Course contents

Content	Full- and part-time intramural studies		Part time extramural studies	
	Contact Hours	Indep. work	Contact Hours	Indep. work
Markov Chains. Discrete-Time Markov Chains. Markov Chain Transition Matrix. Markov Matrices	1	0	0	0
Markov Chains. Eigenvalues and Eigenvectors of P. Constructing the State Transition Matrix P. Transient Behavior.	1	0	0	0
Markov Chains. Expanding P in Terms of Its Eigenvalues. Jordan Canonic Form (JCF). Properties of Jordan Canonic Form.	1	0	0	0
Markov Chains at Equilibrium. Significance of s at "Steady State". Finding Steady-State Distribution Vectors.	1	0	0	0
Markov Chains at Equilibrium. Finding s by Using Difference Equations. Finding s Using Z-Transform.	1	0	0	0
Markov Chains at Equilibrium. Finding s by Using Iterative Techniques. Balance Equations	1	0	0	0
Queuing Analysis. Queue Throughput (Th). Traffic Conservation. M/M/1 Queue	1	0	0	0
Queuing Analysis. M/M/1 Queue Performance. M/M/1/B Queue. M/M/1/B Queue Performance.	1	0	0	0
Queuing Analysis. Mm/M/1/B Queue. Performance Bounds on Mm/M/1/B Queue. M/Mm/1/B Queue.	1	0	0	0
Queuing Analysis. M/Mm/1/B Queue Performance .The D/M/1/B Queue.	1	0	0	0

Queuing Analysis. Performance of the M/D/1/B Queue. Systems of Communicating Markov Chains. A General Solution	1	0	0	0
Modelling Traffic Flow Control Protocols. The Leaky Bucket Algorithm. Modelling the Leaky Bucket Algorithm.	1	0	0	0
Modelling Traffic Flow Control Protocols. Multiple Arrival/Single Departure Model (Mm/M/1 /B). Leaky Bucket Performance	1	0	0	0
Modelling Traffic Flow Control Protocols. Modelling the Token Bucket Algorithm. Single Arrival/Single Departure Model	1	0	0	0
Modelling Medium Access Control Protocols. Modelling the IEEE 802.1p: Static Priority Protocol. Modeling the ALOHA Netw	1	0	0	0
Modelling the Slotted ALOHA Network. IEEE Standard 802.3 (CSMA/CD). IEEE 802.3 (CSMA/CD) Protocol Performance.	1	0	0	0
Carrier Sense Multiple Access-Collision Avoidance (CSMA/CA). CSMA/CA Protocol Performance. IEEE 802.11	1	0	0	0
Modelling Network Traffic. Modulated Poisson Processes. On–Off Model. Markov Modulated Poisson Process	1	0	0	0
Continuous-Time Modelling: Poisson Traffic Description. Flow Description. Interarrival Time Description.	1	0	0	0
Discrete-Time Modeling: Interarrival Time for Bernoulli Traffic. Realistic Models for Bernoulli Traffic	1	0	0	0
Modeling Network Traffic. Self-Similar Traffic. Heavy-Tailed Distributions. Pareto Traffic Distribution	1	0	0	0
Modeling Network Traffic. Destination Statistics	1	0	0	0
Scheduling Algorithms. Packet Selection Policy. Packet Dropping Policy. Fair Sharing Policy	1	0	0	0
Scheduling Algorithms. Scheduler Design Issues. Packet Drop Policy. First-In/First-Out (FIFO)	1	0	0	0
Static Priority (SP) Scheduler Round Robin Scheduler (RR). Queuing Analysis for RR.	1	0	0	0
Processor Sharing (PS). Generalized Processor Sharing (GPS). Fair Queuing (FQ).	1	0	0	0
Core-Stateless Fair Queuing (CSFQ). Determination of Packet Arrival Rate	1	0	0	0
Switches and Routers. Networking. Media Access Techniques.	1	0	0	0
Switches and Routers. Packet Switching Hardware.	1	0	0	0
Switch Functions. Routing. Traffic Management. Scheduling. Congestion Control	1	0	0	0
Interconnection Networks. Network Design Parameters. Network Performance. Network Hardware.	1	0	0	0
Interconnection Networks. Classification of Networks	1	0	0	0
Total:	32	0	0	0

Learning outcomes and assessment

Learning outcomes	Assessment methods
Students should be able to identify and discuss the concepts underlying networks and their main characteristics, and functionality;	Oral Exam Assessment of the research project
Students should be able to explain and exemplify current QoS architectures and mechanisms, and the QoS support challenges in future networks;	Oral Exam Assessment of the research project
Students should be able to understand and explain the design issues in transport services in face of applications and services requirements;	Oral Exam Assessment of the research project
Students should be able to understand theoretical and practical concepts behind the design of multiconstrained applications and services;	Oral Exam Assessment of the research project
Students should be able to discuss relevant management issues and devise adequate network management solutions;	Oral Exam Assessment of the research project
Students should be able to identify and assess possible research opportunities and difficulties within the framework of the course.	Oral Exam Assessment of the research project
Students should be able to engage in doctoral-level research in this field.	Oral Exam Assessment of the research project

Study subject structure

Part	CP	Hours per Week			Tests		
		Lectures	Practical	Lab.	Test	Exam	Work
1.	5.0	5.0	0.0	0.0		*	