RTU Course "TeletrafficTheory"

13104 Telekomunikāciju tīklu katedra

General data

Code	RAE305
Course title	TeletrafficTheory
Course status in the programme	Compulsory/Courses of Limited Choice
Course level	Undergraduate Studies
Course type	Academic
Field of study	Electronics and Telecommunications
Responsible instructor	Gunārs Lauks
Academic staff	Viktors Zagorskis
Volume of the course: parts and credits points	1 part, 3.0 Credit Points, 4.5 ECTS credits
Language of instruction	LV, EN, RU, DE
Possibility of distance learning	Planned
Maximum auditorium capacity	2
Maximum number of students per semester	120
Abstract	The course gives knowledge and skills of modelling, analysis and simulation of telecommunication networks as mass service systems. Dealing with M/M/1, M/M/k systems analytically. The use of Markov chains as mathematical models. Acquiring skills in simulation of systems with Petrie nets and other simple simulating tools (Java Simulation TOOLS).
Goals and objectives of the course in terms of competences and skills	The goal of the course is to ensure that the results of the study course are reached. The objectives of the course are the following: To acquire skills of modelling, analysis and evaluation of mass service systems with the help of Markov process; To acquire skills to numerically solve LDVS and LAVS, that describe Markov process and evaluate performance of the systems; To acquire skills to use analytical models, evaluate simple and complex queues that are used in modelling of networks and protocols; Mathematical modelling of various telecommunication systems and their traffic, Acquire skills to use system simulating methods with the help of Petrie nets.
Structure and tasks of independent studies	There will be sixteen lectures and eight practical classes. Exercises are the essential part of the course. The material will be presented rigorously during the class for the most important results. Additional material is available at the class websites.
Recommended literature	1.Lauks, G. Lekciju konspekts. Rīga: RTU, 2007. 2.Kavacis, A., Lauks, G . Daudzprotokolu iezīmju komutēšana MPLS. Rīga: RTU, 2008. Grāmatas elektroniskā formātā: 3.Nain, Ph. Basic Elements of Queueing Theory. Application to the Modelling of Computer Systems: Lecture Notes, France: INRIA, 2004. Available: www.cs.columbia.edu/~misra/COMS6180/nain.pdf 4.Willig, A. A Short Introduction to Queueing Theory. Technical University Berlin, Telecommunication Networks Group. 5.Cooper, R.B. Introduction to Queueing Theory. Florida: Atlantic University, 6.Perros, H. Computer Simulation Techniques: The definitive introduction!, Computer Science Department, NC State University, 7.Adan, I., Resing, J. Queueing Theory. Department of Mathematics and Computing Science Eindhoven University of Technology. The Netherlands, 8.Fiche, G., Hebuterne, G. Communicating Systems & Networks: Traffic & Performance, London and Sterling, 9. Willig, A. Performance Evaluation Techniques – Summer 2004, Hasso-Plattner-Institut, Universit¨at Potsdam, June 29, 2004. 10.ARUN K. SOMANI. SURVIVABILITY AND TRAFFIC GROOMING IN WDM OPTICAL NETWORKS. Cambridge University Press, 11.Handbook TELETRAFFIC ENGINEERING. Geneva, 2005. Ārzemju universitāšu lekciju slaidi: 1.Yannis A. Korilis. Networking Theory & Fundamentals. University of Pensilvania. 2. Vishal Misra. Computer Systems: Modeling and Performance Evaluation. Columbia University. 3.Midkiff, S.F. Network Performance, Design, and Management. Bradley Department of Electrical and Computer Engineering, Virginia Polytechnic Institute and State University, 4.Lui, J.C.S. Computer System Performance Evaluation, CUHK 5.J´anos Sztrik. Finite-Source Queueing Systems and their Applications. University of Debrecen, Institute of Mathematics and Informatics, Department of Information Technology, 6. Eytan Modiano. Data Networks. Massachusetts Institute of Technology. Laboratory for Information and Decision Systems,
Course prerequisites	Calculus, Probability theory and Statistics

Course outline

Theme	Hours
Introduction. Objectives and methodology	2
Queueing systems	4
Markov Process	4
Discrete Time Markov Chains (DTMC)	4
Continuous Time Markov Chains (CTMC)	6
Birth – Death process (BD)	4
Analytical solutions	6
Queueing Networks	4
Simulation of queueing systems	4
Markov Chains Monte-Carlo (MCMC)	4
Petri Networks	4
Conclusions. Advanced Topics	2

Learning outcomes and assessment

Learning outcomes	Assessment methods
Students are able to use analytical solutions to perform analysis of simple and complicated queues as models of telecommunications networks and protocols	Exam Test Homework
Students are able to perform network traffic modelling	Test Homework
Students are able to use numerical methods to perform analysis of simple and complicated queues as models of telecommunications networks and protocols	Exam Test Homework
Students are able to use Petri Networks for simulation of simple and complicated queues as models of telecommunications networks and protocols	Exam Test Homework
Students are able to use other Simulation Tools (JMT) for simulation of simple and complicated queues as models of telecommunications	Exam Test Homework

Study subject structure

Part	CP	ECTS	Hours per Week			Tests		
			Lectures	Practical	Lab.	Test	Exam	Work
1.	3.0	4.5	2.0	1.0	0.0		*	