RTU Course "Teletraffic Theory"

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General data

Code	RAE700
Course title	Teletraffic Theory
Course status in the programme	Compulsory/Courses of Limited Choice
Responsible instructor	Ingrīda Lavrinoviča
Academic staff	Viktors Zagorskis
Volume of the course: parts and credits points	1 part, 4.0 Credit Points, 6.0 ECTS credits
Language of instruction	LV, EN
Annotation	Internet of Things (IoT) promises the integration of the physical world into computer-based systems, infrastructures, and platforms. Straight applications of IoT leads to several Quality of Service (QoS) issues and pitfalls based on constraints such as intermittent connectivity of mobile devices, limited performance of inexpensive hardware, and availability of resources in emergency response scenarios. The study course addresses the studies on service systems performance modelling. Students gain the knowledge and elaborate skills by studying methodologies for analysis and performance assessment of general and IoT networks. Students learn by applying Queueing Theory techniques in practice, and by using mass service systems (MSS) models and Petri Nets in their work.
Goals and objectives of the course in terms of competences and skills	The goal of the study course is showing students a modern approach of service models in the next generation IoT systems, its design principles, and development tools. The objectives of the study course are * to build the set of skills to monitor, describe and build traffic models in new generation Internet networks; * to develop skills and capabilities to address traffic problems in distributed systems; * to develop the skills to model and analyse IoT sensor networks as a mass service system (MSS), using Markov processes and Petri Nets; * to develop the skills to evaluate the performance of IoT networks according to the fundamental quality of service criteria: response time, network capacity and network utilization.
Structure and tasks of independent studies	The present study course intended to be implemented as lessons involving lectures, demonstrations, discussions, and practical team works in class. To evaluate results and control students' independent studies, study course staff from time to time organizes, seminars on home works, online tests, as well as mid-term assignments. At the end of the study course period, students present their final capstone project. Learning process involves interactive online learning resources, Queueing Systems and IoT related software modeling. Modelling outcomes students verify by programming of sensor systems models in distributed computing environments.
Recommended literature	Obligātā/Obligatory: 1.J. F. Shortle, J. M. Thompson, D. Gross, C. M. Harris “Fundamentals of Queueing Theory 5th Ed.”, Wiley, 2018. - 576 p. Papildu/Additional: 2.S. S. Oyewobi, K. Djouani, A. M. Kurien “Using Priority Queuing for Congestion Control in IoT based technologies for IoT application”, International Journal of Communication Systems, Vol. 34, 2021. 3.T. T. Zin, P. Tin, H. Hama “Characterizing Reliability Measure for Internet of Things by Markov Queue”, Data Science and Pattern Recognition Journal, Vol.2, 2, 2018. – 1-10 p. Citi informācijas resursi/ Other information resources: 1.https://www-dssz.informatik.tu-cottbus.de/DSSZ/Software/Snoopy 2.https://www.prismmodelchecker.org/
Course prerequisites	Fundamentals of probability theory, fundamentals of mathematical statistics and fundamentals of programming.

Course contents

Content	Full- and part-time intramural studies		Part time extramural studies	
	Contact Hours	Indep. work	Contact Hours	Indep. work
Introductory lecture. Aim of the study course, goals, and methodology.	2	0	0	0
Statements of the research problems, tasks, simulation methods and tools.	8	6	0	0
Traffic and queueing tasks, methods, tools, and decision-making models.	8	6	0	0
Queueing modeling, analysis, simulation, and prediction.	8	6	0	0
Queueing algorithms (in-depth analysis), their assessment methods and rankings.	10	8	0	0
Routing algorithms in distributed networks: methods and protocols.	8	10	0	0
Resource management in IoT networks, methods, modelling principles and tools.	10	12	0	0
The principles of secure networking in sensor networks.	8	10	0	0
Introduction to machine learning in sensor networks: tasks, methods, and tools.	8	12	0	0
Security aspects of the IoT systems. Attack schemes, tasks, methods, and tools.	8	10	0	0

Closing lecture. Advanced tasks and topics.	2	0	0	0
Total:	80	80	0	0

Learning outcomes and assessment

Learning outcomes	Assessment methods
Is able to compare and evaluate different theoretical and analytical approaches to handling traffic and queueing tasks.	Assignment: solving numerical and analytical tasks in class.
Is able to demonstrate critical understanding of the topical material outlined in scientific publications and to express their opinion.	Assignment: solving tasks outside the class. Creating reports, presenting work results.
Is able to demonstrate an in-depth understanding of the resource management, safety, and machine learning technologies in IoT and sensor networks.	Assignment: course work consisting of micro-projects. Creating reports, presenting work results.
Can expose a holistic picture of their capabilities and skills in the context of a given study course.	Exam: solving calculation tasks. Creating reports, presenting work results.

Evaluation criteria of study results

Criterion	%
Assignments	30
Course project	30
Exam	30
Academic excellence	10
Total:	100

Study subject structure

Part	CP	Hours per Week			Tests		
		Lectures	Practical	Lab.	Test	Exam	Work
1.	4.0	2.0	2.0	0.0		*	