RĪGAS TEHNISKĀ
UNIVERSITĀTE

RTU Course "Telecommunications and Computer Networks"

13104 null

General data

Code	RAE348
Course title	Telecommunications and Computer Networks
Course status in the programme	Compulsory/Courses of Limited Choice
Responsible instructor	Andris Skrastiņš
Volume of the course: parts and credits points	1 part, 3.0 Credit Points, 4.5 ECTS credits
Language of instruction	LV, EN
Annotation	Telecommunication industry is growing fast due to broad development of telecommunication and computer network technologies. In this study course students acquire knowledge about architecture and working principles of telecommunication and computer networks. An explanation of ISO OSI 7-layer reference model and TCP/IP protocol stack comparison is provided. Students learn computation principles of Ethernet transmission medium, local computer network design, development and virtualization. Students also gain an understanding of different network types - local, metropolitan, territorial, their differences and available transmission technologies. Students learn how to protect a computer network against loops by using Spanning Tree Algorithm (STA) and STP protocols. The course also introduces students to computer network logical addressing, routing process in packet switched networks and routing table creation. Students evaluate and compare best route calculation algorithms of different routing protocols. This course also contains an overview of transport layer protocols (TCP and UDP) operation and comparison. An introduction to VoIP. Students are able to evaluate QoS parameters and required resources. Network management and administration, troubleshooting principles and tools. It is intended for this course to be implemented as lessons, that includes lectures, online demonstrations, discussion and practice works.
Goals and objectives of the course in terms of competences and skills	The aim of this course is to study structure, development and operational principles of telecommunication and computer networks. In this course, students acquire the necessary skills and competencies such as: To provide knowledge of packet transmission concept in computer networks according to ISO OSI 7-layer reference model. Introduce to telecommunication and computer network structure, possible topologies and protocols. Introduce to static and dynamic routing processes and protocols. To develop knowledge and skills to capture and analyze network data flows. Introduce to data flow characteristics and quality criteria as well as possible solutions for quality assurance. To develop skills in computer network design and management.
Structure and tasks of independent studies	Students must acquire topics covered in lectures, do practice works and prepare for practice works and online tests. Submit practice work results before the deadline. In practice works students complete assigned tasks, create reports of results, and are able to explain and demonstrate them.
Recommended literature	Obligāta/Obligatory: 1. Kurose James F., Computer networking: a top-down approach 7th ed, Boston: Pearson, 2017 2. Silvia Hagen. IPv6 Essentials. O'Reilly, 2014. 3. Edwards J., Bramante R., Networking self-teaching guide, Wiley, 2009 Papildu/Additional: 4. Carrell L., Laura Chappell A., Guide to TCP/IP 4th ed., Boston, MA: Course Technology, 2013 5. Ganguly S., VoIP: wireless, P2P and New Enterprise Voice over IP, Wiley, 2008 6. Wendel Odom, Rick McDonald. Routers and Routing Basics. Cisco Press, 2007 7. James Macfarlane. Network Routing Basics. Wiley, 2006. 8. Panwar Shivendra S., TCP/IP essentials, Cambridge: Cambridge University Press, 2004 Citi informācijas avoti/ Other sources of information: 9. All materials available on the Internet on the topics of this course.
Course prerequisites	Basic knowledge about computer facilities or knowledge gained in course Digital Electronics and Computer Architecture (RAE261)

Course contents

Content	Full- and part-time intramural studies		Part time extramural studies	
	Contact Hours	Indep. work	Contact Hours	Indep. work
Introduction to the study course, history, development and operation principle of computer networks. Network topologies, different network sizes: territorial, metropolitan and local area network.	4	2	0	0
Communication process and data processing hierarchy according to the ISO OSI-7 layer reference model. TCP / IP protocol suite. Information exchange codes (ASCII, Unicode).	4	2	0	0

Ethernet as the main transmission medium in the local area network (LAN). Ethernet frame structure and addressing principles. Necessity and structure of MAC address table.	4	2	0	0
IPv4 and IPv6 addressing on computer networks. Domain Name Service (DNS).	4	6	0	0
IP address subnetting. ARP protocol. Network services (NAT, DHCP, DNS).	4	6	0	0
Packet switching within OSI Layer 2. Spanning tree algorithm and protocols (STP, RSTP, pvst).	4	4	0	0
Virtualization in computer networks. Virtual Local Area Network (VLAN), trunk and access ports, 802.1q, VTP, LLDP protocols.	4	2	0	0
IP routing principles in telecommunication and computer networks. Routing table. Static routing. Significance of IP classes in routing.	2	4	0	0
Dynamic routing protocols. Distance-vector routing protocol (RIP), link-state routing protocol (OSPF), hybrid routing protocols.	4	8	0	0
Analysis and comparison of routing protocols. GNS3 network emulation tool.	4	2	0	0
Computer network troubleshooting tools. ICMP protocol. Network packet capture and analysis - tcpdump, Wireshark tools.	4	6	0	0
Transport layer protocols TCP/UDP. Principle of TCP protocol operation, comparison of TCP protocol algorithms. UDP protocol.	6	4	0	0
Voice over Internet Protocol (VoIP) transmission. SIP protocol and H.323 protocol suite, RTP and MGCP protocol.	4	6	0	0
Quality of Service (QoS) management. Traffic characteristics. Packet scheduling algorithms, queuing algorithms. Hierarchical token bucket (HTB).	4	2	0	0
Network measurements and management principles and tools. SNMP protocol.	4	4	0	0
Total:	60	60	0	0

Learning outcomes and assessment

Learning outcomes	Assessment methods
Students understand structure and operational principles of telecommunication and computer networks and have acquired knowledge of its development trends.	Test, exam.
Students are able to do network address planning according to desired computer network topology independently. Are able to explain functional significance of network devices.	Test, exam.
Students understand QoS parameter importance and their effect on data transmission in packet switched networks. Have acquired understanding about resource management principles.	Test, exam.
Students are able to develop a computer network in a simulation or virtualization environment.	Test and practice works.
Students can demonstrate an understanding of the data transmission process in computer networks. Are able to evaluate and compare routing protocols.	Test and practice works.
Students are able to resolve basic network problems and knows several troubleshooting tools to solve them. Are able to check network node connection, have skills in use of network troubleshooting and analyze tools.	Practice works.

Evaluation criteria of study results

Criterion	%
Tests (4)	30
Practice works (6)	40
Exam	30
Total:	100

Study subject structure

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