COMPUTER NETWORKS 2

ACADEMIC YEAR 2024-2025

Degree	**B**achelor of **S**cience in **C**omputer **S**cience			
Qualification	**C**omputer **S**cience			
Professor	PhD, Robert Tadevosyan			
Distribution of hours	CM 18h.	TD 12h.	TPS 60h.	ECTS 3

EXPECTED LEARNING OUTCOMES OF THE COURSE		
A- Knowledge		A 1.1 Understanding the general computer network architecture A 1.2 To get knowledge about OSI model concept and realizations A 1.3 Deep understanding the network protocols, working principals and layers interactions
B-Skills	**B1 -** Skills to apply professional knowledge	B 1.1 Ability to applying the acquired knowledge in production B 1.2 Working in different layers of network starting from physical to application B 1.3 Ability to configure the networking on devices and working desktops/servers B 1.4 Ability to using the network monitoring tools for detecting problems B 1.5 Will able to valuable skills in computer networks (switching, routing), system and network administration, computer and network security and project management. B 1.6 Analyze a complex computer network problems and to apply principles of networking and other relevant disciplines to identify solutions. B 1.7 Student will able to configure operating systems, network specific services, routing, switching, and remote access solutions
	B2 - General (transversal) skills	B 2.1 Be an advanced network user B 2.2 Understanding the whole working processes in computer network B 2.3 Designing and creating computer networks B 2.4 To be engaged in continuing professional development or professional societies in computer networking or a related computing field. To follow standards set forth by professional societies of which they are members." B 2.5 To be able to pursue productive careers in computer networking or a related computing field.

KNOWLEDGE / SKILLS ASSESSMENT & EVALUATION		
Ongoing evaluation tasks *(max 1/3 of grade for the total course)*	**Midterm exam**	**Final exam**
Assessment : Oral ☐ Written ☐	Assessment : Oral ☐ Written ☐	Assessment : Oral ☐ Written ☐
Duration : XXX h. Criteria :	Group base: Yes ☐ No ☐	Group base: Yes ☐ No ☐
Course project : Yes ☐ No ☐ Presentation : Yes ☐ No ☐	Duration : 1.5 h.	Duration : 1.5 h.
Tasks type & Weight : XXXXXX	Exam type : XXXXXX	Exam type : XXXXXX

TEACHING METHODS & TOOLS

Lecture, Explanation, Slideshow, Presentation, Demonstration, Video-presentation, Practical Work, Group work, Debate, Exercises, Instruction with demonstration, Problem-solving learning

KNOWLEDGE & SKILLS PREREQUISITS

Basic Computer Skills	It is important to have a good understanding of how to use computers, including knowledge of operating systems like Windows, macOS, or Linux.
Fundamental Knowledge of Computer Science	Concepts such as data structures, algorithms, and programming languages are beneficial as they form the basis of understanding how network protocols work.
Understanding of the Internet	Familiarity with how the internet works, including concepts like IP addresses, domain names, and how data is transmitted over the internet, can be helpful
Knowledge of Operating Systems	Understanding how operating systems manage resources, handle processes, and provide networking services is essential for grasping networking concepts
Mathematics	Basic knowledge of mathematics, including algebra and probability, can be useful for understanding certain networking concepts like error detection and correction. Good understanding of mathematical concepts such as binary and hexadecimal numbering systems help in understanding computer networking
Programming Skills	While not always a strict requirement, having programming skills in languages like Python, Java, or C can be beneficial for tasks such as network programming and automation
Curiosity and Problem-Solving Skills	Networking often involves complex problem-solving, troubleshooting, and critical thinking. Having a curious mindset and the ability to troubleshoot issues systematically are important skills in this field
Resources	It's helpful to have access to resources such as textbooks, online courses, tutorials, and networking equipment (like routers and switches) for hands-on practice

COURSE DESCRIPTION /SYLLABUS / RESOURCES

COURSE DESCRIPTION:

This course will cover the principles and working processes of computer networks. Will be revealed the network structure, starting from the lowest physical layer till application layer, and work in the internet. Will be studied the principles of work of the network protocols as well as the ways of diagnosing the problems. Also will be the reviewed the mainly used networking equipment and how monitor network configuration examples of commonly encountered problem. Also will be the lab works, based on existing equipment, for getting the practical knowledge of creating networks, based on theoretical studies of the studied material.

TOPIC	HOURS					CORE RESOURCES	ADDITIONAL RESOURCES
	CM	CTD	CTP	TD	TP		
Network/Transport Layer • IP Routing; Routers working principals • IP packed forwarding principals: Within LAN, Within WAN • RIP, OSPF, BGP protocols • TCP - Transmission Control Protocol, UDP - User Datagram Protocols - working principals. Using areas • Understanding Port in TCP/IP system	6			6			
Application Layer ▪ DNS - structure and working principals ▪ Nslookup software working principals ▪ DHCP (Server, Client) system; working principal	3			1.5			

Dynamic DNS							
Application Layer ▪ Mainframe/Supercomputer, Clusters, Grid ▪ Cloud Services; Types of cloud services - IaaS, PaaS, SaaS. Public and private clouds. Access methods to network servers: ▪ Telnet/SSH/RDP protocols, Virtual Terminal. Working principals ▪ FTP/FTPS/SFTP protocols. Working principals ▪ HTTP/HTTPS protocols and working principals ▪ SMTP, POP, IMAP – protocols and working principals	6			3			
Application Layer and Security Principals ▪ Firewall systems ▪ NAT, PAT systems ▪ Proxy Server working principals ▪ VPN	3			1.5			

STRUCTURE OF THE COURSE & ADDITIONAL INFORMATION REGARDING THE COURSE PREPARATION

Information regarding the course resources available in the web

- https://www.juniper.net/documentation/
- https://kb.juniper.net/InfoCenter/index?page=home
- https://www.cisco.com/c/en/us/support/all-products.html
- https://www.cisco.com/c/en/us/tech/index.html
- https://help.mikrotik.com/docs/

Resources & tools needed for course, including software and hardware with appropriate technical requirements descriptions

- **For lectures** - Computer, Projector, Electronic sensor board with projector (or blackboard)

- **For practical works** – Network cable (CAT5e standard), RJ45 connectors, RJ45 Crimping tools, Network smart switches (for example: Mikrotik, D-Link), Network routers with advanced functions (for example, Mikrotik), Wi-Fi APs (for example: Mikrotik, TP-Link, D-Link), Working desktops with Oracle VM VirtualBox installed (8/16GB RAM with free HDD space for VMs)

CORE REFERENCES

1. Pearson, Computer Networking: A Top-Down Approach (6th Edition) (2012)
2. O'Reilly Media, Network Warrior (2nd Edition) (2011)
3. Wiley, The All-New Switch Book: The Complete Guide to LAN Switching Technology (2nd Edition) (2008)
4. Cisco Press, Routing TCP/IP, Volume 1 (2nd Edition) (2005)
5. Cisco Press, Routing TCP/IP, Volume II: CCIE Professional Development (2nd Edition) (2016)
6. Tilted Windmill Press, Networking for Systems Administrators (IT Mastery) (2019)

ADDITIONAL REFERENCES

1. Practical Packet Analysis, 3E: Using Wireshark to Solve Real-World Network Problems 3rd Edition (2017)
2. Computer Networking with Internet Protocols and Technology/Authors: William Stallings/Pearson
3. Paul Love, Joe Merlino, Jeremy C./Beginning Unix/Wiley Publishing, Inc
4. Joseph Davies and Tomas Lee/Microsoft Windows Server2003 TCP/IP protocols
5. And Services Technical Reference/Microsoft Press, 2003, ISBN : 0-73-5612919
6. Mattew J. Castelli/Lan Switching first-step/ Cisco Press, 2004, ISBN : 1-58720-100-3
7. David Barnes, Basir Sakandar/Cisco LAN Switching Fundamentals/Cisco Press, 2004, ISBN 1-58705-089-7

WEB RESOURCES

1. http://www.petri.co.il

2. http://technet.microsoft.com
3. http://www.cisco.com/
4. https://en.wikipedia.org/wiki/Computer_network
5. https://www.journals.elsevier.com/computer-networks/
6. http://www.cs.vu.nl/~ast/