Yuriy Fedkovych Chernivtsi National University

(full name of the higher education institution)

Educational and Scientific Institute of Physical, Technical and Computer Sciences

(name of the institute/faculty)

Department of Computer Systems and Networks

(name of the epartment)

SILABUS

of the academic discipline

Cisco Network Information Technologies (in English)

(indicate the name of the discipline (in foreign language, if the discipline is taught in a foreign language))

mandatory

(mandatory or optional)

Educational and scientific programme ***Computer Engineering of Internet of Things and Cyber-Physical Systems Technologies***

Speciality ***123 - Computer engineering***

(code and name of speciality)

Field of knowledge ***12 - Information technology***

(indicate: first (bachelor's)/second (master's)/third (educational and scientific))

Educational and Scientific Institute of Physical, Technical and ComputerSciences

(name of the faculty/institute where specialists are trained under the specified educational and professional programme)

Languages of instruction: ***Ukrainian, English***

(language in which the discipline is taught)

Developer: Yuliya Tanasiyuk, Associate Professor of the Department of Computer Systems and Networks, PhD in Physics and Mathematics

(indicate authors (lecturer (ив)), their positions, academic degrees, academic titles)

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Course page in Moodle https://lms.netacad.com/course/view.php?id=2100555
https://moodle.chnu.edu.ua/course/view.php?id=5097

Consultations *on-line: Monday from 14.40 to 16.00*

1. Summary of the discipline

The discipline "Cisco Networking Information Technologies" is based on the CCNAv7 professional course from Cisco Networking Academy®. This discipline is designed to develop the professional qualities necessary to build a career in engineering, computer networks and telecommunications. The list of topics for lectures and practical assignments is primarily devoted to modern computer networking technologies and their implementation in corporate environments and Internet of Things systems. In particular, such areas as segmentation, redundancy, channel aggregation, load balancing, routing and switching, network and service security, implementation of wireless technologies, network programming and automation provide students with ample opportunities to gain practical experience in implementing effective solutions for deploying, administering and diagnosing industrial computer networks.

2. The purpose of the discipline "Cisco Network Information Technologies: studying the basic technologies for building local and global corporate computer networks, getting acquainted with routing algorithms and how to implement them in practice, mechanisms for creating virtual local and virtual private networks, implementing the necessary security measures and the proper level of service in a computer network.

2.1. Objectives of the discipline:

- familiarisation with the functionality, structure, hardware and software components of the Cisco routers and switches;
- studying the basic algorithms for finding the optimal path for data transmission over the network, implemented in such routing protocols as RIP v1 and v2, EIGRP, OSPF v2 and v3, and the peculiarities of their application when setting up communication between remote networks;
- mastering the basic means of protecting a corporate network and its individual parts from unauthorised access, transporting malicious traffic or gaining control over product resources;
- studying hardware and software methods of segmenting a corporate network based on Cisco switches and routers;
- familiarisation with modern means of effective IP address allocation using IP protocols versions 4 and 6, DHCPv4 and v6 and creation of subnets of different levels depending on the needs of the industrial network;
- study of global networking technologies, features of their implementation and use; the concept of quality of service (QoS) in converged networks during the simultaneous transmission of data, voice and video.

3. Prerequisites. To successfully master the material, students must first study the following disciplines: Fundamentals of Algorithmisation, Applied Theory of dDgital Automata, Computer Arithmetic, Algorithms and Methods of Computation, Object Communication Devices, Computer Architecture, Computer Systems, Computer Networks, System Software.

4. Learning outcomes

As a result of studying the discipline, students should:

Know: the structure, main components of routers and their purpose; types and functions of routing protocols, features of their configuration; characteristics and functions of switches; types of switching; principles of loop prevention algorithm; basics of virtual local and private networks; basic technologies for building global networks; global network protocols and how to configure them; mechanisms for controlling and limiting traffic in local and global networks.

Be able to*:* configure and view basic router parameters; create static routes; configure dynamic router protocols and verify the ways packets being transported over networks; create and apply access control lists; use switches to segment and microsegment the corporate network, ensure scalability, availability and security of corporate networks.

Acquire competences:

General competences (GC):

GC1. Ability to adapt and act in a new situation.
GC2. Ability to think abstractly, analyse and synthesise.
GC4. Ability to search, process and analyse information from various sources.
GC6. Ability to identify, formulate and solve problems.
GC7. Ability to make informed decisions.
GC8. Ability to communicate in a foreign language.

Special (professional) (SC):

SC1. Ability to determine the technical characteristics, design features, application and operation of software, hardware, computer systems and networks for various purposes.
SC2. Ability to develop algorithmic and software, components of computer systems and networks, Internet applications, cyber-physical systems using modern programming methods and languages, as well as design automation tools and systems.
SC3. Ability to build and research models of computer systems and networks.
SC4. Ability to build architecture and create system and application software of computer systems and networks.
SC5. Ability to use and implement new technologies, including smart, mobile, green and secure computing technologies, to participate in the modernisation and reconstruction of computer systems and networks, various embedded and distributed applications, in particular to improve their efficiency.
SC6. Ability to research, develop and select technologies for creating large and ultra-large systems.
SC7. Ability to identify, classify and describe the operation of software and hardware, computer systems, networks and their components.
SC8. Ability to choose effective methods for solving complex computer engineering problems, critically evaluate the results obtained and justify the decisions made.

Programme learmning outcomes (PLO)

PLO2. Find the necessary data, analyse and evaluate it.
PLO3. Build and study models of computer systems and networks, evaluate their adequacy, determine the limits of applicability
PLO6. Analyse issues, identify and formulate specific problems that need to be solved, choose effective methods of solving them.
PLO7. Solve problems of analysis and synthesis of computer systems and networks.
PLO8. To apply knowledge of technical characteristics, design features, purpose and rules of operation of software and hardware of computer systems and networks to solve complex problems of computer engineering and related problems.

PO10. Search for information in various sources to solve computer engineering problems, analyse and evaluate this information.
PLO11. Make effective decisions on the development, implementation and operation of computer systems and networks, analyse alternatives, assess risks and possible consequences of decisions.
PLO12. Communicate fluently orally and in writing in Ukrainian and one of the foreign languages (English, German, Italian, French, Spanish) when discussing professional issues, research and innovation in the field of information technology.
PLO13. Clearly and unambiguously communicate own knowledge, conclusions and arguments on information technology and related interdisciplinary issues to specialists and non-specialists, including students.

5. Description of the discipline

5.1. General information

Form of study	Year of training	Semester	Quantity		Number of hours						Type of final control
			credits	total hours	lectures	practical	seminars	labs	independent work	individual tasks	
Full-time	5	9	4	120	15	-	-	15	90	-	Exam

5.2. Didactic map of the discipline

Content module 1: Fundamentals of switching, routing and wireless networks
Topic 1: Routers and switches: their functions, purpose, and configuration.
Topic 2. Scaling of local networks. Virtual local area networks (VLANs) and intere-VLAN routing.
Topic 3. Availability and redundancy of local network resources.
Topic 4. Security of local and wireless networks.
Topic 5. Routing concepts and configurations.

Titles of content modules and topics	Number of hours					
	total	including				
		lec	pr	lab	it	ind
1	2	3	4	5	6	7
Content module 1: *Fundamentals of switching, routing and wireless networks*						
Topic 1	21	3	-	4	-	14
Topic 2.	21	3	-	2	-	16
Topic 3.	23	3	-	2	-	18
Topic 4.	26	3	-	3	-	20
Topic 5.	29	3		4		22
Total hours	**120**	**15**	**-**	**15**	**-**	**90**

5.3. Topics of laboratory works

ID	Topics (assignments)	Number of hours
Content module 1: Fundamentals of switching, routing and wireless networks		
1.	Basic router configuration	2
2.	Securing the router for administration access	2
3.	VLAN and inter-VLAN routing configuration	2
4.	Configuring EtherChannel	2
5.	Switch security configuration	3
6.	Static and default routes configuration. Point-to-point single- area OSPFv2 configuration	4
	Total:	**15**

Note. Methodological recommendations and assignments for laboratory work are available on the following Internet resources:
https://lms.netacad.com/course/view.php?id=2100555
https://drive.google.com/drive/folders/1AJh7gO01QRpfpQApnHhK0eDWjSZucu5N

Software for performing laboratory work:

- Cisco Packet Tracer v 8.2.0 and higher.
- Tera Term client software with SSH source for lab PCs.
- Wireshark version 3.6.7 or higher.

5.4. Independent work

ID	Topics	Number of hours
1.	Structure and configuration of switch parameters. Principles of switching. Layer 2 and Layer 3 switches.	4
2.	Peculiarities of router booting-up. The configuration register.	3
3.	Dynamic Trunking Protocol (DTP)	5
4.	Inter-VLAN routing based on a Layer 3 router	4
5.	EtherChannel. PAgP, LACP	6
6.	FHRP operating principles	4
7.	Deploying and configuring wireless LANs	8
8.	Dynamic routing.RIP v 1, 2, RIPing	6
9.	Troubleshoot static and default routes	5
10.	Multi-area OSPF routing configuration	8
11.	Types of network attacks on local networks and methods of preventing them	5
12.	A protocols for supporting data trunk lines and virtual local area networks. VTP protocol	3
13.	VPN and IPSec operation	8
14.	Wireless local, metropolitan, and global network technologies.	8
15.	Principles of network design. Building hierarchical networks.	5
16.	Troubleshooting IP-networks	8
	Total:	**90**

6. Forms and methods of training

Forms of education include problem-based and review lectures, laboratory classes, classes with the use of computer and telecommunications equipment, interactive classes withone student teaching another, video lectures, video conferencing via Google Meet, Cisco Webex, classes using the Moodle e-learning system and the educational portal of the Cisco Network Academies Programme - netacad.com.

Methods: problematic presentation of material, partially search and research laboratory workshops, presentations, consultations and discussions, work in the Internet classroom: electronic lectures, laboratory work, distance consultations, etc. aimed at activating and stimulating students' educational and cognitive activities.

Approaches to teaching: student-centred, problem-based, activity-based, communicative, professionally oriented, interdisciplinary approaches are used.

The educational process is carried out during lectures, laboratory classes, independent extracurricular work with the use of modern information teaching tools, softwaresimulators, virtual teamwork environments, and consultations with teachers.

The following **teaching methods are** used to develop **skills and abilities**:

- verbal/verbal *(lecture, explanation, story, conversation, instruction);*
- visual *(observation, illustration, demonstration);*
- practical *(conducting an experiment, practice);*
- explanatory and illustrative, which involves the presentation of ready-madeinformation by the teacher and its assimilation by students*;*
- Reproductive *(performing laboratory tasks based on a sample);*
- the method of problem-based presentation of material in laboratory classes.

7. Monitoring and evaluation system

Means of assessing and demonstrating learning outcomes:

- virtual simulation environments according to predefined scenarios;
- tasks on laboratory equipment;
- laboratory work;
- self-check quizzes;
- tests;
- presentations and justification of the results of completed tasks.

The forms of current control of the level of knowledge are oral and written answers of the student during the defence of completed laboratory works, presentation of the results of practicaltasks in the form of a report, the number of points obtained in the performance of test tasks. The final control is carried out by passing the final exam.

7.1. Criteria for assessing learning outcomes in the discipline

The criterion for the successful completion of the final assessment by the student is theachievement of the minimum threshold levels of grades for each planned learning outcome of the discipline.

Assessment scale and criteria: national and ECTS
(European Credit Transfer System)

ECTS grades	Criteria	Explanation	Rating on a 100-point scale	Score on the national scale (exam/test)
A	Excellent level of competence within the mandatory material, with possible minordeficiencies	excellent/ passed	**90 - 100**	**excellent/ passed**
B	A sufficiently high level of competence within the mandatory material without significant (gross) errors	very good passed	**80-89**	**good/ passed**
C	Overall good level of competence with few errors	good/ passed	**70-79**	
D	Mediocre level of competence with a significant number of deficiencies, sufficient for further study or professional activity	satisfactory/ passed	**60-69**	**satisfactory/ passed**
E	Minimum acceptable level of competence	enough/ passed	**50-59**	
FX	Unsatisfactory level of competence, with the possibility of retaking the examwith proper independent revision	unsatisfactory/ failed	**35-49**	**unsatisfactory/ failed**
F	Very poor level of competence, requiring repeated study of the discipline	unsatisfactory/ failed	**1-34**	

Distribution of the maximum possible number of points that students obtaine for completing all types of learning activities

Current assessment (classroom and independent work)						**Final control (exam)**	**Total number of points**
Content module							
T1	T2	T3	T4	T5	MC1	40	100
7	7	12	7	7	20		

The forms of final control are tests and practical tasks in a virtual modelling environment and a distance learning system.

If a student receives more than 70 points per semester, he or she is awarded a certificate of successful completion of the CCNAv7.0 SRWE (Switching, Routing and Wireless Essentials) course from Cisco Networking Academy.

7.2. The list of topics and the distribution of the maximum number of points that students receive for completing all types of learning activities

Content module 1: Fundamentals of switching, routing and wireless networks

Topic 1. Routers and switches: their functions, purpose and configuration (laboratory work No. 1 - 100 points, laboratory work No. 2 - 100 points)

Topic 2. Scaling local area networks. Virtual Local Area Networks (VLANs) and routing between them (laboratory work No. 3 - 5 points, Group test 1-4. The concept of switching, VLAN and inter-VLAN routing - 100 points).
Topic 3. Availability and redundancy of local area network resources (laboratory work No. 4 - 100 points, Group test 5-6. Network redundancy - 100 points, Group test 7-9. Available and reliable networks - 100 points).
Topic 4. Security of local and wireless networks. Wireless networks. (Laboratory work No. 5 - 100 points, Group test 10-13. Layer 2 and WLAN security - 100 points).
Topic 5. The concept and configuration of routing. (Laboratory work No. 6 - 100 points, Group test 14-16. The concept and configuration of routing - 100 points).
Module control test (Assessment of practical skills) - 100 points.
Final test (exam) - 100 points.
The total amount of points for the semester is determined by the formula:

STP=((LWT+MCT)/2)*0,4 + GTT*0,2+FE*0,4,

where **STP** – total points for semester (maximum – 100);
LWT – total points for laboratory works (maximum – 40);
MCT – points for module control test (maximum – 20);
GTT – total points for the group tests (maximum – 20);
FE – final exam total points (maximum – 40).

7.3. Conditions for crediting non-formal education results

According to the Regulations of the Chernivtsi National University "On non-formal education", a student may receive additional points or be exempted from certain types of work on certain topics if he or she has certificates of non-formal education on issues that are covered by the discipline "Cisco Network Information Technologies (in English)".

8. Recommended references

8.1. Main (professional)

1. CCNAv7: Introduction to Networks (ITN). URL: https://www.netacad.com/courses/networking/ccna-introduction-networks
2. CCNAv7: Switching, Routing and Wireless Essentials (SRWE). URL: https://www.netacad.com/courses/networking/ccna-switching-routing-wireless-essentials
3. CCNAv7: Enterprise Networking, Security and Automation (ENSA). URL: https://www.netacad.com/courses/networking/ccna-enterprise-networking-security-automation.
4. Мережні інформаційні технології Cisco: навчальний посібник / Укл. Танасюк Ю.В. – Чернівці: ЧНУ, 2022. – 192 с.
5. Микитишин А.Г., Митник М.М. , Стухляк П.Д., Пасічник В.В. Комп’ютерні мережі. книга.1. Навчальний посібник для технічних спеціальностей ВНЗ (рекомендовано МОН України). - Магнолія 2006, 2021. – 256 с.
6. Микитишин А.Г., Митник М.М. , Стухляк П.Д., Пасічник В.В. Комп’ютерні мережі. книга.2. Навчальний посібник для технічних спеціальностей ВНЗ (рекомендовано МОН України). - Магнолія 2006, 2021. – 328 с.

7. Todd Lammle Understanding Cisco Networking Technologies, Volume 1. - Sybex, 2019. - 400 p.
8. Cisco Networking Academy Switching, Routing, and Wireless Essentials Companion Guide (CCNAv7). - Cisco Press, 2020. – 525 p.

Supplemental

1. Комп’ютерні мережі: підручник / Азаров О.Д., Захарченко С.М., Кадук О.В., Орлова М.М., Тарасенко В.П. – Вінниця: ВНТУ. – 2020. – 378 с.
2. Jerry FitzGerald, Alan Dennis, Alexandra Durcikova Business Data Communications and Networking, 14th Edition. – Kindle, 2020. - 416 p.
3. Chris Carte, William Wilson, Noel Rivera Cisco Networks: Engineers' Handbook of Routing, Switching, and Security with IOS, NX-OS, and ASA. – Apress, 2021. – 620 p.

9. Internet resources

1. Computer Network Fundamentals. URL: https://www.geeksforgeeks.org/basics-computer-networking/
2. Computer Networking Notes URL:. https://www.computernetworkingnotes.com/
3. CCIE Routing & Switching. URL: https://networklessons.com/
4. Learn Cisco. URL: https://www.learncisco.net/
5. Network Troubleshooting. URL: https://www.comptia.org/content/guides/a-guide-to-network-troubleshooting
6. Network Protocols. URL: https://www.firewall.cx/networking-topics/protocols.html
7. CCNA Free Courses. URL: https://www.ictshore.com/free-ccna-course/
8. IoT Architecture. URL: https://www.geeksforgeeks.org/architecture-of-internet-of-things-iot/