**Syllabus**
Course Program

# GLOBAL COMPUTER NETWORKS

Specialty
172 Electronic communications and radio engineering

Institute
Institute of Computer Modeling, Applied Physics and Mathematics

Educational program
Network technologies and telecommunications

Department
Information systems named after V.O. Kravets (169))

Educational level
Master's degree

Course type
Special (professional), Mandatory

Semester
2

Language of teaching
English

## Lecturers and course developers

**Nataliia Dzheniuk**

Nataliia.Dzheniuk@khpi.edu.ua
Associate Professor of NTU "KhPI", Associate Professor of the Department of Information Systems named after V.O. Kravets of NTU "KhPI". Work experience - 38 years. Author of more than 40 scientific and educational works. Leading lecturer in the following disciplines: "Computer Networks", "Computer Engineering and Information Technologies", "Algorithmization and Programming", "Global Computer Networks".
Learn more about the teacher on the department's website

## general information

### Abstract

The discipline is aimed at mastering network and telecommunication technologies. It determines and provides highly qualified training for the implementation of technologies for the development and justification of network configuration, traffic assessment in segments, application of techniques for implementing network protocols using software, application of technologies for setting and solving problems of designing interaction in a global computer network, application of computer equipment, network equipment, application software in solving theoretical and practical problems in the design and configuration of networks.

### Purpose and goals disciplines

Mastering network and telecommunication technologies by students. Obtaining information about the methods of network development and configuration, traffic assessment in segments, selection of network equipment and software. Mastering the techniques of configuring global networks, implementing network protocols using software. Gaining skills in modern integrated programming systems for the implementation of network protocols.

### Format of classes

Lectures, laboratory work, independent work, consultations. The final control is a test.

### Competences

GC-1. Ability to think abstractly, analyze and synthesize.
GC-2. Ability to apply knowledge in practical situations
GC-3. Knowledge and understanding of the subject area and understanding of professional activities.
GC-9. Ability to develop and manage projects.
SC-1. Ability to apply scientific facts, concepts, theories, principles and methodologies of scientific research.
SC-2. Ability to implement the principles of a systematic approach in conducting research on processes occurring in electronic communication and radio engineering systems, complexes and devices.
SC-5. Ability to develop, improve and use modern software, hardware and software and hardware of electronic communication and radio engineering devices (tools, systems, complexes).

### Learning outcomes

LO-1 - to organize own professional, research and innovation activities based on the principles of a systematic approach and research methodology.
LO-3 - develop and implement modern and advanced telecommunication and radio engineering systems, complexes, technologies, devices and their components
LO-8 - apply general and specialized programming languages, analytical and simulation modeling packages, as well as software and hardware development tools to solve complex problems of telecommunications and radio engineering

### Scope of the discipline

The total volume of the discipline is 150 hours (5 ECTS credits): lectures - 32 hours, laboratory work - 32 hours, independent work - 86 hours.

### Prerequisites for studying the discipline (prerequisites)

"Architecture of computer networks", "System software of telecommunication systems"

### Features of the discipline, methods and technologies of education

In the course of teaching the discipline, the teacher uses explanatory and illustrative (information and receptive) and reproductive teaching methods. Presentations, conversations, individual group projects, and master classes are used as teaching methods aimed at activating and stimulating the educational and cognitive activities of students.

## Program of educational discipline

### Topics of lectures

Topic 1: Introduction. Design of hierarchical networks. New network architectures.
Topics 2-3. Overview of global network technologies. The principle of operation of the global network.
Topic 4. Point-to-point communication channels.
Topic 5. WAN encapsulation protocols.
Topic 6. DSL. Wireless broadband networks.
Topic 7. PPPoE protocol.
Topics 8-9. VPN technology.
Topic 10. GRE tunnels between objects. Configuring GRE tunnels.
Topic 11: Using IPsec to protect network traffic.
Topic 12: BGP protocol parameters. eBGP and iBGP. Stages of eBGP configuration.
Topic 13: Network virtualization. Cloud models.
Topic 14: SDN architecture.
Topic 15. QoS mechanisms.
Topic 16. Network monitoring.

### Topics of practical classes

Practical work within the discipline is not provided.

### Topics of laboratory works

Topic 1: Comparison of Level 2 and Level 3 devices.
Topic 2. Troubleshooting serial interfaces.
Topic 3. Research of broadband Internet access technologies.
Topic 4. Organization of WAN.
Topic 5. Setting up PAP and CHAP authentication.
Topic 6. Troubleshooting PPP with authentication.
Topic 7. Configuring the GRE protocol.
Topic 8: Configuring GRE.
Topic 9: Configuring the router as a PPPoE client for DSL connection.
Topic 10. Configuring a GRE point-to-point tunnel in a VPN network.
Topic 11. Configuring and testing eBGP.
Chapter 12: Using LLDP to display network topology.
Topic 13. Configuring and testing the NTP protocol.
Topic 14: Exploring network monitoring software.
Topic 15: Configuring the IP SLA ICMP Echo.
Topic 16. Testing of complex practical skills.

### Independent work

Independent work of students is one of the forms of organization of education, the main form of mastering the educational material in their free time. During independent work, students study lecture material, prepare for laboratory work, tests and exams.

## Literature and educational materials

### Basic literature

1. Computer networks, book.1. Textbook for technical specialties of higher education institutions (recommended by the Ministry of Education and Science of Ukraine) / Mykytyshyn A.G., Mytnyk M.M., Stukhlyak P.D. - Lviv: Magnolia 2006, 2021. 256 p.
2. Evseev S.P., Dzheniuk N.V., Tolkachev M.Y., Korol O.G., Voropai N.I. Computer networks. Book 1: Technologies of computer networks. Textbook / Yevseev S.P., Dzheniuk N.V., Tolkachov M.Y. et al. - Kharkiv, - Lviv: Publishing House "Novyi Svit - 2000", 2023. 470 p.
3. Burov E.V. Computer networks: Textbook / Burov E.V., Mytnyk M.M.; Edited by Pasichnyk V.V. Lviv: Magnolia 2019. 204 p. (MES of Ukraine).
4. Vorobienko P.P., Nikitiuk L.A., Reznichenko P.I. Telecommunication and Information Networks: Textbook for higher education institutions / P.P. Vorobienko, L.A. Nikitiuk, P.I. Reznichenko - K.: Summit Book, 2010. 708 p.
5. Computer networks Part. 2. TEXTBOOK [Electronic resource]: a textbook for students majoring in 121 "Software Engineering" and 126 "Information Systems and Technologies", specialization "Software Engineering of Information Management Systems" and "Information Support of Robotic Systems" / B. Y. Zhurakovskyi, I. Zeniv; Igor Sikorsky Kyiv Polytechnic Institute - Electronic text data (1 file: 5.7 MB) - Kyiv : Igor Sikorsky Kyiv Polytechnic Institute, 2020. 372 p.
6. Oleshchenko L.M. Organization of computer networks: lecture notes [Electronic resource] / L.M. Oleshchenko: Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2018. 225 p.
7. Computer networks: a textbook / Horodetska O. S., Hykavyi V. A., Onyshchuk O. V.. - Vinnytsia: VNTU, 2017. - 129 c.
8. Cisco Networking Academy Program: CCNA 1 and 2. Companion Guide, Third Edition. – Cisco Press, 2004. – 1048 p.
9. Cisco Networking Academy Program: CCNA 3 and 4. Companion Guide, Third Edition. – Cisco Press, 2004. – 948 p.
10. Cisco Networking Academy Program: Networking Essentials Companion Guide CiscoPress, 2022. – 544 p.
11. Computer Networks. Technologies, protocols and modeling: Study guide / Yu.V. Stasev, I.V. Ruban, S.V. Dudenko, D.V. Sumtsov, O.I. Tymochko - Kharkiv: KHNUPS, 2015.
12. Valetska T.M. Computer networks. Hardware. Study guide. - K.: Center for Educational Literature, 2012. -208c.

13. Wendell Odom, Official Cisco Prep Guide for CCNA ICND2 200-101 Certification Exam: Routing and Switching, Academic Edition, ISBN 978-5-8459-1907-6.
14. Kulakov Y.O., Lutskyi H.M. Computer Networks - Kyiv, "Junior", 2005. 397 p.

### Additional literature

1. Computer networks. General principles of operation of computer networks. Study guide. Minukhin S.V., Kavun S.V., Znakhur S.V. - Kharkiv: KNEU Publishing House, 2008. - p. (In Ukrainian) p.
2.Pogorelyi S.D. Computer networks. Hardware and data transfer protocols: a textbook for students of higher educational institutions / S.D. Pogorily, D.M. Kalita; edited by O.V. Tretyak. - K.: VPC "Kyiv University", 2007. - 455 c.
3.Computer networks: a textbook / [Azarov O.D., Zakharchenko S.M., Kaduk O.V. and others] - Vinnytsia: VNTU, 2013. 371 p.

## Evaluation system

### Criteria for evaluating student performance and distribution of points

Points are awarded as follows ratio :
• laboratory work : 30% of the semester evaluations ;
• independent work: 20% of the semester evaluations ;
• test: 50% of the semester assessments .

### Rating scale

| Total points | National rating | ECTS |
|---|---|---|
| 90–100 | Perfectly | A |
| 82–89 | Fine | B |
| 75–81 | Fine | C |
| 64–74 | Satisfactorily | D |
| 60–63 | Satisfactorily | E |
| 35–59 | Unsatisfactory (requires further study) | FX |
| 1–34 | Unsatisfactorily (re-study required) | F |

## Norms of academic ethics and policy of the course

The student must adhere to the "Code of Ethics of Academic Relations and Integrity of NTU "KhPI": show discipline, education, benevolence, honesty, responsibility. Conflict situations should be openly discussed in study groups with the teacher, and if it is impossible to resolve the conflict, it should be brought to the attention of the employees of the institute's directorate.
Regulatory and legal support for the implementation of the principles of academic integrity of NTU "KhPI" is posted on the website: http://blogs.kpi.kharkov.ua/v2/nv/akademichna-dobrochesnist/

## Coordination

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|---|---|---|
| Syllabus agreed | Date of approval, signature | Head of Department<br>Pavel PUSTOVOYTOV |
| | Date of approval, signature | Guarantor OP<br>Vitaliy BRESLAVETS |