

# COMPUTER NETWORKS

## SYLLABUS

|                                       |                                     |                            |  |
|---------------------------------------|-------------------------------------|----------------------------|--|
| <b>Code and name of the specialty</b> | 122 – «Computer Science»            | <b>Institute / faculty</b> | NTU "KhPI" / computer science                              |
| <b>Name of the program</b>            | Working program of the discipline   | <b>Chair</b>               | Software engineering and information technology management |
| <b>Program type</b>                   | <b>Educational and professional</b> | <b>Language learning</b>   | english  |

### Teacher

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#### General information - scientific degree, academic title, position, number of publications, basic courses ...

Candidate of Technical Sciences, Professor of NTU "KhPI", Professor of the Department of Software Engineering and Information Technology Management of NTU "KhPI". Experience of pedagogical work - 35 years. Author of about 120 scientific and educational works. Leading lecturer in the following disciplines: "Computer Circuitry", "Computer Architecture", "Computer Networks", "Fundamentals of Web Technologies", "Distributed computing and cloud services", "Cloud Computing". the textbook in co-authorship is developed: Godlevsky M. D. Formation of strategies of development of corporate computer systems / M. D. Godlevsky, S. V. Shevchenko. - Kharkiv: NTU "KhPI", 2017. (Recommended by the Academic Council of NTU "KhPI") (80% of the author's contribution)

### General information about the course

|  |  |                         |    |                                   |    |                                 |    |
|--|--|-------------------------|----|-----------------------------------|----|---------------------------------|----|
| <b>Summary</b>   | The discipline program considers the principles of construction and basic characteristics of computer networks, their structure, composition of main components, their purpose and use, principles of system management, criteria for optimizing operation, organization of hierarchy of management processes, construction and use of information and control messages in exchange data, system of protocols and network interfaces, principles of construction of local computer networks, features of the organization of the Internet and the WWW network, application of web technologies of creation of corporate distributed information systems are studied.<br>In the materials of lectures and tasks of laboratory works the questions of adjustment and management of performance of processes of exchange of information with orientation on perspective directions of development of network technologies are considered. |                         |    |                                   |    |                                 |    |
| <b>Course objectives</b>   | Analysis of the current state of computer networks and network technologies, mastering the principles of building distributed computer systems based on the organization and use of data transmission subsystems to ensure qualitative and quantitative characteristics of high-performance distributed information systems for various purposes.  |                         |    |                                   |    |                                 |    |
| <b>Types of classes and control</b>                                | Lectures, laboratory work, consultations. Final control - test   |                         |    |                                   |    |                                 |    |
| <b>Term</b>  | 3  |                         |    |                                   |    |                                 |    |
| <b>Volume (credits) / Type of course</b><br>(Required / Selective) | 3 / Required e   | <b>Lectures (hours)</b> | 32 | <b>Laboratory classes (hours)</b> | 32 | <b>Independent work (hours)</b> | 26 |
| <b>Program competencies</b>  | GC1. Ability to abstract thinking, analysis and synthesis.<br>GC2. Ability to apply knowledge in practical situations.<br>GC3. Knowledge and understanding of the subject area and understanding of professional activity.   |                         |    |                                   |    |                                 |    |

GC6. Ability to learn and master modern knowledge.  
 PC13. Ability to develop network software that operates based on different topologies of structured cable systems, uses computer systems and data networks, and analyzes the quality of computer networks.  
 PC14. Ability to apply methods and tools of information security, to develop and operate special software for security of information resources of critical information infrastructure.

| Learning outcomes   | Teaching and learning methods  | Forms of evaluation<br>(current CAS assessment, final FAS assessment)   |
|---|--|---|
| PLO13. Know the system programming languages and methods for the software development that interacts with the components of computer systems, know network technologies, computer network architectures, have practical skills in administration technology of computer networks and their software.<br>PLO15. Understand the concept of information security, the principles of secure software design, ensure the security of computer networks in conditions of incomplete and uncertain input data. | Interactive lectures with presentations, discussions, laboratory classes, case method, feedback from students, problem-based learning. | Written individual assignments for laboratory work (CAS), assessment of knowledge in laboratory classes (CAS), rapid surveys (CAS), online tests (CAS), final / semester control in the form of a semester test, according to the schedule of the educational process (FAS) |

### ASSESSMENT AND GRADING

| Distribution of points for assessing the success of graduate students | Total score (points) for all types of learning activities | ECTS grading scale | The national grading scale                               | Allocation of grade points |   |      |
|---|---|--------------------|--|----------------------------|---|------|
|   | 90-100  | A                  | excellent  |                            | <b>100% Final assessment</b> as a result of Final test (250%) and Continuous assessment (75%).<br><b>25% Final test</b><br><b>75% Continuous assessment:</b><br>Module №1 (15%)<br>Module №2 (15%)<br>Laboratory works (45%)<br>Laboratory work №1 (5%)<br>Laboratory work №2 (5%)<br>Laboratory work №3 (5%)<br>Laboratory work №4 (7%)<br>Laboratory work №5 (8%)<br>Laboratory work №6 (8%)<br>Laboratory work №7 (7%) |      |
|   | 82-89   | B                  |  |                            |   | good |
|   | 74-81   | C                  | satisfactory   |                            |   |      |
|   | 64-73   | D                  |  |                            |   |      |
|   | 60-63   | E                  |  |                            |   |      |
|   | 35-59   | FX                 | Unsatisfactory (with the exam retake option)             |                            |   |      |
|   | 0-34  | F                  | Unsatisfactory (with mandatory repetition of the course) |                            |   |      |

**Course policy**

The policy of the academic discipline is determined by the system of requirements for the study of the discipline, the inadmissibility of omissions, the implementation of the required minimum of educational work; incentives and penalties - accrual or deduction of points. The policy of the discipline is based on the norms of the legislation of Ukraine on academic integrity, the Charter, the provisions of NTU "KhPI".

For violation of academic integrity, students may be held subject to the following academic liability:

- reduction of the results of evaluation of control work, credit;
- re-assessment of control work, credit;
- appointment of additional control individual tasks, tests, tests.

Without the personal presence of the student the final control is not carried out.

## The structure and content of the course

|                   |   |                    |  |                        |   |
|-------------------|---|--------------------|--|------------------------|---|
| <b>Lecture 1</b>  | Principles of construction and components of computer networks. Main characteristics. Network processing efficiency. Criteria for evaluating effectiveness.   | Laboratory work 1. | Analysis of the computer's network environment (PT01, PT43).   | <b>Individual work</b> | The structure of the IPv.6 packet header and the use of the contents of the header fields |
| <b>Lecture 2</b>  | Management organization. The process of data processing in the network. Independence of management tasks of different levels. Interaction of processes. Message. Gates.   | Laboratory work 2. | Analysis of the functional environment of modeling the construction of virtual local area networks (PT20). |                        | Ensuring the bandwidth of virtual channels  |
| <b>Lecture 3</b>  | Addressing in computer networks. Addressing objects. Types and procedures of addressing. Process communication blocks.  | Laboratory work 3. | Simulation of association remote nodes based on concentrators of local area networks (PT01, PT44).         |                        | Dynamic routing on the Internet   |
| <b>Lecture 4</b>  | Management processes in computer networks. Computer network management objects. Model of interaction of open OSI systems. Protocols. Protocol families.   | Laboratory work 4. | Modeling the structuring of local area networks using switches (PT42, PT46).                               |                        |   |
| <b>Lecture 5</b>  | Routing in computer networks. Routing conditions. Routing criteria.   | Laboratory work 5. | Simulation of routers and application of static routing in local area networks (PT14).                     |                        |   |
| <b>Lecture 6</b>  | Classification of routing algorithms. Simple routing algorithms. Fixed routing. Adaptive routing.   | Laboratory work 6. | Analysis of procedures for determining the local address of network nodes (PT46).                          |                        |   |
| <b>Lecture 7</b>  | Flow management. Management levels. Management of reliability and control of integrity of the information transferred in a network. Combination of the mechanism of receipts and control of time of execution of process of transfer. | Laboratory work 7. | Modeling the organization of wireless access to a local area network (PT42).                               |                        |   |
| <b>Lecture 8</b>  | Distribution of flow management functions. Lock prevention technologies.  |                    |  |                        |   |
| <b>Lecture 9</b>  | Local area networks. Topologies and equipment. Features of management organization. Basic architectures of local computer networks.   |                    |  |                        |   |
| <b>Lecture 10</b> | Network adapters. LAN protocols. The composition of messages and the content of their fields  |                    |  |                        |   |
| <b>Lecture 11</b> | Internet. Principles of construction and characteristics. Addressing.   |                    |  |                        |   |
| <b>Lecture 12</b> | Protocols. IP-class address. Subnet masks   |                    |  |                        |   |

|                   |  |  |  |  |
|-------------------|--|--|--|--|
| <b>Lecture 13</b> | Features of management in the Internet. Routing. Connection quality support. |  |  |  |
| <b>Lecture 14</b> | Бездротові комп'ютерні мережі. Мережі Wi-Fi.                                 |  |  |  |
| <b>Lecture 15</b> | Client-server technologies on the Internet. Application layer protocols.     |  |  |  |
| <b>Lecture 16</b> | WWW network and web technologies. Development prospects                      |  |  |  |

### RECOMMENDED READING

|            |  |   |
|------------|--|---|
| Compulsory | <ol style="list-style-type: none"> <li>1. Зайченко О. Ю., Зайченко Ю. П. (2010) Комп'ютерні мережі: Київ : Слово,</li> <li>2. Буров С.В. (2010) Комп'ютерні мережі: підручник. Львів: «Магнолія 2006».</li> <li>3. Кулаков Ю. О., Жуков І. А. (2009) Комп'ютерні мережі Київ: вид-во Нац. авіац. ун-ту «НАУ-друк»,.</li> </ol> | <ol style="list-style-type: none"> <li>1. BOINC – Berkeley Open Infrastructure for Network Computing. URL: <a href="http://boinc.berkeley.edu/">http://boinc.berkeley.edu/</a>. (Дата звертання: 19.05.2020).Retriyevd from</li> <li>2. Skype. URL: <a href="http://www.skype.com">http://www.skype.com</a> (Дата звертання: 02.06.2017).</li> <li>3. Milojcic D. S.(2003) et al. Peer-to-Peer Computing, Hewlett-Packard, Tech. Rep. HPL-2002-57R1. URL: <a href="http://www.hpl.hp.com/techreports/2002/HPL-2002-57R1.html">http://www.hpl.hp.com/techreports/2002/HPL-2002-57R1.html</a>. (Дата звертання: 19.05.2020).</li> <li>4. Service Oriented Architecture (SOA) Reference Model Public Review Draft 1.0(Feb) / Organization for the Advancement of Structured Information Standards (OASIS). Retriyevd from URL: <a href="http://www.oasisopen.org/committees/download.php/16587/wdsoacd1ED.pdf">http://www.oasisopen.org/committees/download.php/16587/wdsoacd1ED.pdf</a>. (Дата звертання: 4.06.2019).</li> <li>5. Годлевский М. Д., Шевченко С.В. (2017) Формирование стратегий развития корпоративных компьютерных систем : Харьков : НТУ «ХПИ»,.</li> </ol> |
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### Academic integrity

Students are expected to adhere to the Code of Ethics of Academic Relations and Integrity of NTU “KhPI”.

The content of this syllabus is consistent with the course program.