

# [RE-46] BASICS OF INTERNET TECHNOLOGIES AND COMPUTER NETWORKS



## Curriculum of the academic discipline (Syllabus)

### Course details

Level of higher education	First (bachelor's)
Field of knowledge	G - Engineering, manufacturing, and construction
Special	G5 - Electronics, electronic communications, instrument engineering, and radio engineering
Educational program	All
Discipline status	Elective (F-catalog)
Form of higher education	Full-time
Year of training, semester	Available for selection starting from the 3rd year, fall semester
Scope of the discipline	4 credits (Lectures 16 hours, Practical classes 30 hours, Laboratory work 30 hours, Independent work 74 hours)
Semester	
Control/control measures	Exam
Class schedule	<a href="https://schedule.kpi.ua">https://schedule.kpi.ua</a>
Language of instruction	Ukrainian
Information about the course coordinator/teacher s	Lecturer: <a href="#">Litvintsev S. M.</a> , Lab: <a href="#">Litvintsev S. M.</a> , Independent work: <a href="#">Litvintsev S. M.</a>
Course placement	<a href="https://do.ipo.kpi.ua/course/view.php?id=6044">https://do.ipo.kpi.ua/course/view.php?id=6044</a>

### Curriculum

#### 1. Description of the course, its purpose, subject matter, and learning outcomes

The course "Fundamentals of Internet Technologies and Computer Networks" is one of the courses that provides students with knowledge about Internet technologies that are now widely used and deepens their existing understanding of computer networks. This subject develops existing theoretical knowledge and practical skills in building, managing, modernizing, monitoring and analyzing the performance, diagnostics and troubleshooting of modern electronic networks and communications, and their application in communications via the Internet.

After completing the course, students should demonstrate the following learning outcomes:

**1) Knowledge:**

- basic means of communication technology for creating computer networks, their classification and characteristics;
- the purpose, features of operation, and concepts of building local and global computer networks;
- basic technologies of local computer networks and features of their application;
- the basics of the organization and functioning of global computer networks and the services provided to users by such networks;
- the composition and purpose of software tools that ensure the effective and uninterrupted operation of modern computer technologies;
- the domain name system;
- universal resource locator (URL);
- the logical structure of an HTML document and website;
- Principles of search engine construction.

**2) Skills:**

- select and justify the choice of model for building a projected computer network, network architecture, type of cable system, configuration of network equipment necessary to ensure the normal operation of a computer network;
- plan and implement computer networks, manage network resources;
- select a set of necessary hardware and software tools for implementing a computer network;
- expand and modernize networks, diagnose and solve problems that arise in them;
- apply modern technologies (VLAN, PoE, DHCP, etc.) when building networks;
- use Internet search engines;
- create, fill, and ensure the functioning of websites and web communities on the Internet;
- create HTML documents and websites using modern software tools.

**3) Experience:** based on the knowledge and skills acquired, specialists will be able to solve professional tasks based on modern technologies and methods of building computer networks and create HTML documents and websites.

After completing the course, students should demonstrate the following program competencies and learning outcomes (see <https://osvita.kpi.ua/op>):

**General competencies**

GC-2 – Ability to apply knowledge in the case of processing results or random signals.

GC-4 – Knowledge and understanding of the subject area and understanding of professional activities. GC-8 – Ability to identify, pose, and solve problems.

**Special (professional, subject-specific) competencies**

PC-1 – Ability to understand the essence and significance of information in the development of a modern information society.

PC-2 – Ability to solve standard tasks of professional activity using information and communication technologies and taking into account the basic requirements of information security.

PC-3 – Ability to use basic methods, means, and tools for obtaining, transmitting, processing, and storing information.

PC-4 – Ability to perform computer modeling of devices, systems, and processes using universal application software packages.

PC-5 – Ability to use regulatory and legal documentation related to information and telecommunications networks (laws of Ukraine, technical regulations, international and national standards, recommendations of the International Telecommunication Union, etc.) to solve

professional tasks.

PC-6 – Ability to perform instrumental measurements in information and telecommunications networks and telecommunications systems.

PC-8 – Willingness to promote the implementation of promising technologies and standards.

PC-10 – Ability to install, debug, configure, adjust, test, and commission telecommunications equipment.

PC-11 – Ability to compile regulatory documentation (instructions) for the operational and technical maintenance of information and telecommunications networks and telecommunications systems, as well as for testing programs.

PC-12 – Ability to perform work related to managing the load flows of information and telecommunications networks.

PC-15 – Ability to perform calculations in the process of designing information and telecommunications networks and telecommunications systems in accordance with technical specifications using both standard and independently developed methods, techniques, and design automation software.

#### Learning outcomes

- analyze, argue, and make decisions when solving specialized tasks and practical problems in telecommunications, which are characterized by complexity and incomplete certainty of conditions;
- apply the results of personal research and analysis of information to solve qualitative and quantitative problems of a similar nature in information and communication networks and telecommunications systems;
- explain the results obtained from measurements in terms of their significance and relate them to the relevant theory;
- skills in evaluating, interpreting, and synthesizing information and data;
- adapt to changes in information and communication network technologies and telecommunications systems;
- properly apply telecommunications industry terminology;
- describe the principles and procedures used in telecommunications systems and information and telecommunications networks;
- analyze and evaluate the effectiveness of methods for designing information and telecommunications networks and telecommunications systems;
- tolerantly perceive and apply ethical standards of behavior towards other people;
- apply fundamental and applied sciences to analyze and develop processes occurring in telecommunications systems;
- apply an understanding of the basic properties of the component base to ensure the quality and reliability of telecommunications systems and devices;
- apply an understanding of the means of automation of design and technical operation of telecommunications systems in professional activities;
- applying an understanding of the basics of metrology and standardization in the field of telecommunications in professional activities;
- understanding and complying with domestic and international regulatory documents on the development, implementation, and technical operation of information and telecommunications networks and telecommunications systems;
- finding, evaluating, and using information from various sources necessary for solving professional tasks, including reproducing information through electronic search;
- conduct standard tests of information and communication networks and telecommunications systems for compliance with the requirements of domestic and international regulatory documents;
- explain the principles of construction and operation of hardware and software complexes of control and maintenance systems for the development, analysis, and operation of information and telecommunications networks and telecommunications systems;
- ensure the reliable and high-quality operation of information and communication networks and telecommunications systems;
- monitor the technical condition of information and communication networks and telecommunications systems during their technical operation in order to identify deterioration

in performance or failures, and systematically record this through documentation.

## **2. Prerequisites and postprerequisites of the discipline (place in the structural-logical scheme of training under the relevant educational program)**

To master this discipline, knowledge of the following disciplines is required: "Computer Science 1. Fundamentals of Programming and Algorithms," "Computer Science 2. Fundamentals of Computing," "OTKRT 1 Fundamentals of Electronic Communications Networks."

The knowledge gained in this discipline will ensure mastery of the following disciplines: "Fundamentals of Signal Coding and Encryption Theory," "Radio Systems for Various Purposes," "Machine Learning in Radio Engineering Computerized Systems," "Technical Protection in Information Systems," "Information Security," "Mobile Communication Systems," "New Generation Mobile Communication Systems," and "Web Services and Applications."

### **3. Course content**

#### **I. Fundamentals of computer networks**

##### **Section 1. Principles of network construction and**

elements  
Topic 1.1. RSO  
Topic 1.2. The role of the network  
Topic 1.3. Topology, network components  
Topic 1.4. Wireless, mobile, global networks

##### **Section 2. Network**

Architecture  
Topic 2.1.

The Concept of

Architecture  
Topic 2.2. Terminal-mainframe architecture  
Topic 2.3. Client-server architecture  
Topic 2.4. Peer-to-peer architecture  
Topic 2.5. Computer-network architecture  
Topic 2.6. Intelligent network architecture

##### **Section 3. Network models**

Topic 3.1. OSI and TCP/IP  
reference models  
Topic 3.2. OSI  
protocol stack  
Topic 3.3. TCP/IP protocol stack  
Topic 3.4. Microsoft TCP/IP protocol  
stack  
Topic 3.5. IPX/SPX protocol  
stack  
Topic 3.6. Comparison of models

##### **Section 4. Access Methods**

Topic 4.1. General  
characteristics  
Topic 4.2.  
CSMA/CD access method  
Topic 4.3. CSMA/CA access  
method  
Topic 4.4. TPMA  
access method  
Topic 4.5. DPP  
access method

##### **Section 5. Communication channels and lines**

Topic 5.1. Concept of a  
communication channel  
Topic

5.2. Types of communication lines  
Topic 5.3. Cable systems  
Topic 5.4. Structured cabling system

## **Section 6. Characteristics of**

communication lines Topic 6.1.

Types of characteristics  
Topic 6.2. Amplitude-frequency characteristics Topic 6.3. Bandwidth  
Topic 6.4. Noise immunity  
Topic 6.5. Data transmission reliability Topic 6.6. Nyquist and Shannon formulas

## **Chapter 7. Ethernet cable**

systems Topic 7.1. Types of

Ethernet  
Topic 7.2. 10BASE5 Ethernet  
Topic 7.3. 10BASE2 Ethernet  
Topic 7.4. 10BASE-T Ethernet  
Topic 7.5. 10BASE-FL Ethernet  
Topic 7.6. 100BASE-TX  
Ethernet Topic 7.7. 100BASE-T4  
Ethernet Topic 7.8. 100BASE-FX  
Ethernet

## **Chapter 8. Addressing in IP Networks**

Topic 8.1. Address space and types of addresses Topic 8.2. Local addresses (MAC)  
Topic 8.3. Network addresses (IP) Topic 8.4. Network addresses (IP) Topic 8.5. Character addresses (DNS)  
Topic 8.6. Calculating IPv4 subnets  
Topic 8.7. IPv6 and its comparison with IPv4

## **Chapter 9. Management in computer networks**

Topic 9.1. NAT (Network Address Translation)  
Topic 9.2. DHCP (Dynamic Host Configuration Protocol)  
Topic 9.3. VLAN (Virtual Local Area Network)  
Topic 9.4. PoE (Power over Ethernet)

## **Chapter 10. Network technologies in Windows**

Topic 10.1. Static and dynamic IP assignment, verification  
Topic 10.2. IPCONFIG command  
Topic 10.3. PING command  
Topic 10.4. ARP command  
Topic 10.5. TRACERT command

Topic 10.6. NSLOOKUP command  
Topic 10.7. Troubleshooting network problems

## **II. Fundamentals of Internet technologies**

### **Section 11. Basic Internet resources**

Topic 11.1. Management, access  
(Telnet)  
Topic 11.2. File transfer (FTP, SFTP, TFTP)  
Topic 11.3. Electronic mail (SMTP)  
Topic 11.4. World Wide Web (WWW) Topic 11.5.  
Uniform Resource Locator (URL) Topic 11.6. Search  
engines  
Topic 11.7. Instant Messaging (IM)  
Topic 11.8. Web forums, blogs, wiki projects, online stores, online advertising Topic 11.9. IP  
telephony, VoIP, IP radio, IPTV  
Topic 11.10. Cloud computing

### **Section 12. FTP servers**

Topic 12.1. What is an FTP server?  
Topic 12.2. Why do you need an FTP  
server? Topic 12.3. How does the FTP  
protocol work?  
Topic 12.4. Installing and configuring an FTP  
server Topic 12.5. How to connect to an FTP  
server

### **Section 13. Web servers**

Topic 13.1. Basic functions of web  
servers Topic 13.2. Criteria for  
choosing web servers  
Topic 13.3. Overview of web servers (Apache, IIS, lighttpd, Google Web  
Server) Topic 13.4. Web server security and causes of vulnerability  
Topic 13.5. Planning web server deployment  
Topic 13.6. Security of the OS on which the web server is  
installed Topic 13.7. Installation and configuration of a web  
server

## **Chapter 14. HTML**

Basics Topic 14.1.  
  
What is HTML  
Topic 14.2. How HTML works  
Topic 14.3. Most commonly used HTML tags  
Topic 14.4. General structure of an HTML  
file Topic 14.5. Built-in tags  
Topic 14.6. Differences between HTML and  
HTML5 Topic 14.7. Pros and cons of HTML  
Topic 14.8. How HTML, CSS, and JavaScript  
are related Topic 14.9. Tool for creating  
HTML

## **Chapter 15. Content management systems**

Topic 15.1. Content and content  
management

Topic 15.2. Content management systems  
(CMS) Topic 15.3. Technical structure of CMS  
Topic 15.4. CMS model  
Topic 15.5. Document management system  
Topic 15.6. Standards in CMS  
Topic 15.7. Classification of CMS systems Topic 15.8. Characteristics of CMS Topic 15.9. Development of CMS Topic 15.10. Commercial CMS systems Topic 15.11. "Open" CMS systems

**PP from**

**the**

**module**

**Test**

#### **4. Training materials and resources**

Basic recommended literature

1. Tarnavskyi Yu. A., Kuzmenko I. M. *Organization of computer networks*. Kyiv: KPI, 2018. 259 p.
2. Vorobiienko P. P., Nikitiuk L. A., Reznichenko P. I. *Telecommunications and Information Networks* : Textbook for Higher Education Institutions. Kyiv: SUMMIT-Book, 2010. 708 p.
3. Mykityshyn, A. G., Mytnik, M. M., Stukhlyak, P. D., Pasichnyk, V. V. *Computer Networks* [textbook]. — Lviv: Magnolia 2006, 2013. 256 p.
4. Pogorily S. D., Kalita D. M. *Computer Networks. Hardware and Data Transfer Protocols: Textbook for Students of Higher Educational Institutions*, edited by O. V. Tretyak. Kyiv: Kyiv University, 2007. 455 p.

Recommended supplementary reading

1. Bilous L. F. *Information Networks: Textbook*. Kyiv: Logos, 2005. 140 p.
2. Stallings W. *Computer Networking with Internet Protocols and Technology*. 2004. 640 p.
3. Kulakov Yu. O., Lutsky G. M. *Computer Networks*. Kyiv: Junior, 2003. 400 p.

### 5. Methodology for mastering the academic discipline (educational component)

#### Lectures

No	Lecture topic and list of main questions
1	<p><i>Principles of network construction and elements</i>          RCO. The role of the network. Topology, network components. Wireless, mobile, global networks</p>
2	<p><i>Network architecture</i>          The concept of architecture. Terminal-mainframe architecture. Client-server architecture. Peer-to-peer architecture. Computer-network architecture.          Intelligent network architecture</p>
3	<p><i>Network models</i>          Reference models OSI, TCP/IP. OSI protocol stack. TCP/IP protocol stack. Microsoft TCP/IP protocol stack. IPX/SPX protocol stack. Comparison of models</p>
4	<p><i>Access methods</i>          General characteristics. CSMA/CD access method. CSMA/CA access method. TPMA access method. DPP access method</p>
5	<p><i>Channels and communication lines</i>          The concept of a communication channel. Types of communication lines. Cable systems. Structured cable network</p>
6	<p><i>Communication line characteristics</i>          Types of characteristics. Amplitude-frequency characteristic. Bandwidth. Noise immunity. Data transmission reliability. Nyquist and Shannon formulas</p>
7	<p><i>Ethernet cable systems</i>          Types of Ethernet. 10BASE5 Ethernet. 10BASE2 Ethernet. 10BASE-T Ethernet. 10BASE-FL Ethernet. 100BASE-TX Ethernet. 100BASE-T4 Ethernet. 100BASE-FX Ethernet</p>
8	<p><i>Addressing in IP networks</i>          Address space and types of addresses. Local addresses (MAC). Network addresses (IP). Network addresses (IP). Character addresses (DNS). Calculation of IPv4 subnets. IPv6 and its comparison with IPv4</p>
9	<p><i>Management in computer networks</i>          NAT (Network Address Translation). DHCP (Dynamic Host Configuration Protocol). VLAN (Virtual Local Area Network). PoE (Power over Ethernet)</p>
10	<p><i>Network technologies in Windows</i>          Static and dynamic IP assignment, verification. IPCONFIG command. PING command. ARP command. TRACERT command. NSLOOKUP command. Troubleshooting network problems</p>
11	<p><i>Basic Internet resources</i>          Management, access (Telnet). File transfer (FTP, SFTP, TFTP). Electronic mail (SMTP). World Wide Web (WWW). Uniform Resource Locator (URL)</p>
12	<p><i>Basic Internet resources</i>          Search engines. Instant messaging (IM). Web forums, blogs, wiki projects, online stores, online advertising. IP telephony, VoIP, IP radio, IPTV. Cloud computing</p>

13	<p><i>FTP servers</i> What is an FTP server? Why do you need an FTP server? How does the FTP protocol work? Installation and configuration of an FTP server. How to connect to an FTP server</p>
14	<p><i>Web servers</i> Basic functions of web servers. Criteria for selecting web servers. Overview of web servers (Apache, IIS, lighttpd, Google Web Server). Web server security and causes of vulnerability. Planning web server deployment. Security of the operating system on which the web server is installed. Installation and configuration of a web server</p>
15	<p><i>HTML basics</i> What is HTML. How HTML works. Most commonly used HTML tags. General structure of an HTML file. Embedded tags.</p>
16	<p><i>HTML basics</i> How HTML and HTML5 differ. Pros and cons of HTML. How HTML, CSS, and JavaScript are related. Tools for creating HTML.</p>
17	<p><i>Content management systems</i> Content and content management. Content management systems (CMS). Technical structure of CMS. CMS model. Document management system. Standards in CMS.</p>
18	<p><i>Content management systems</i> Classification of CMS systems. Characteristics of CMS. Development of CMS. Commercial CMS systems. "Open" CMS systems</p>

Offline laboratory classes

No.	<b>Lesson topic and list of key questions</b>
1	Creating a peer-to-peer network and sharing network resources using TP-Link equipment Learning the web interface for configuring TP-Link equipment
2	Creating a peer-to-peer network and sharing network resources using MikroTik equipment. Learning the RouterOS operating system Configuring and using DHCP and DNS services
3	Creating a local network using VLAN
4	Configuring an FTP server and creating a peer-to-peer network to provide shared access to the server
5	Configuring a web server on a local computer and creating a business card website using HTML
6	Configuring a web server on a local computer, installing a content management system, and creating a business card website

## 6. Independent work by the student

Students must prepare for lectures and laboratory classes in advance. Before lectures, it is necessary to review the theoretical material that was provided in previous lectures or assigned in advance.

Homework assignments for laboratory classes must be completed before the next class.

In order to better assimilate the course material, a calculation assignment (CA) is planned. To prepare for the calculation assignment, students should use the recommended literature, lecture notes, and methodological guidelines for completing the CA. Individual assignments for the calculation assignment are given by the instructor, who also sets deadlines for its submission. The following is performed in the CR:

1. Designing the network structure.
2. Calculations of subnets when distributing allocated IP ranges.
3. Construction of the proposed network structure in a software emulator.
4. Verification of network performance by building it from real elements.
5. Creation of a business card website.
6. Verification of the business card website's operability in the created local network.

The independent work covers some theoretical issues, which are set during the lecture.

## **Policy and control**

### **7. Academic discipline (educational component) policy**

#### **Attendance**

Attendance at lectures and laboratory classes — in accordance with the Regulations on the Organization of the Educational Process at Igor Sikorsky Kyiv Polytechnic Institute. At least once every two weeks, the instructor conducts consultations on various issues related to the credit module. During consultations, the instructor may provide

assistance in studying the material of classes that students have missed for various reasons and must master on their own.

In any case, students are encouraged to attend all types of classes, as they cover theoretical material and develop the skills necessary for completing homework and calculations.

#### **Missed tests**

The result for a student who did not attend a test is zero. If a student misses a test for a valid reason, they are given the opportunity to make it up (complete the lab work) in the presence of the teacher. If the absence was without a valid reason, the issue of making it up is decided with the teacher in consultation with the department management. A missed test is not counted regardless of the reason for the absence; in this case, the student receives a "did not show up" mark, and if they are eligible to take the test, they must take it during an additional session.

#### **Announcement of test results**

The defense of the completed section of the RR takes the form of an interview with the teacher. During the defense, the student must be able to explain the results obtained and answer the main theoretical questions on the topics of the sections. The results of the defense are announced to the student in their presence or remotely and are accompanied by specific comments and remarks regarding errors (remote communication via Discord, Zoom, or Telegram with video and audio).

The results for the completed laboratory work are posted after its completion and defense.

#### **Academic integrity**

The policy and principles of academic integrity are defined in Section 3 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute." For more details, see: <https://kpi.ua/code>.

#### **Standards of ethical behavior**

The standards of ethical conduct for students and employees are defined in Section 2 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute." For more information, visit: <https://kpi.ua/code>.

#### **Procedure for appealing the results of control measures**

Students have the opportunity to raise any issue related to the procedure for conducting and/or evaluating tests and expect that it will be considered in accordance with predetermined procedures.

Students have the right to appeal the results of assessment measures, but must provide a reasoned explanation of which criteria they disagree with according to the assessment sheet and/or comments.

## **8. Types of assessment and the learning outcomes assessment rating system (LOAS)**

The RSO is conducted on a 100-point scale, which allows students to earn the necessary points during the semester and receive an automatic grade for the course (more than 60 points) or take a differential exam.

No.	Control measure	Maximum points	Number	Total
1	Attendance at lectures (test after lecture)	2	9	18
2	Work in laboratory classes	10	6	60
3.	Calculation work	20	1	20
5.	Bonuses	8	1	8
6.	Credit (if you did not score 60)	40	1	40
	Total			100

**Table of correspondence between rating points and university scale grades**

<b>Number of points</b>	<b>Grade</b>
100-95	Excellent
94-85	Very good
84-75	Good
74-65	Satisfactory
64-60	Sufficient
Less than 60	Unsatisfactory
Admission requirements not met	Not admitted

## **9. Additional information on the discipline (educational component)**

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### ***Description of material, technical, and informational support for the discipline***

Laboratory work is carried out in the network technology training laboratory, which has the following equipment:

- TP-Link L2 switches (10 pcs)
- Cisco L2 switches (6 pcs)
- Cisco L3 switches (2 pcs)
- Mikrotik routers (10 pcs)

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The working program of the academic discipline (syllabus):

**Compiled by Litvintsev S. M.:**

**Approved by** the RI Department (Minutes No. 06/2025 dated 24.06.2025)

**Approved by** the methodological commission of the faculty/research institute (protocol No. 06/2025 dated 26.06.2025)