



# Basics of Internet Technologies and Computer Networks (PN-14)

## Curriculum of the academic discipline (Syllabus)

### Course details

<b>Level of higher education</b>	<i>First (bachelor's)</i>
<b>Field of knowledge</b>	<i>17 Electronics, Automation, and Electronic Communications</i>
<b>Special</b>	<i>172 Electronic communications and radio engineering</i>
<b>Educational program</b>	<i>Information and Communication Radio Engineering</i>
<b>Status of discipline</b>	<i>Compulsory for professional training</i>
<b>Form of study</b>	<i>Full-time (daytime)</i>
<b>Year of training, semester</b>	<i>4th year, 7th semester</i>
<b>Scope of the discipline</b>	<i>Total: 4 ECTS credits / 120 hours Lectures: 36 hours Laboratory classes: 36 hours Self-study by students: 48 hours.</i>
<b>Semester control/control measures</b>	<i>Modular tests, homework tests, exams ongoing assessment / defense of laboratory work</i>
<b>Class schedule</b>	<i>Lectures (once a week starting from week 1 Laboratory work (once every two weeks, preferably after the lecture)</i>
<b>Language of instruction</b>	<i>Ukrainian</i>
<b>Information about the course supervisor/teachers</b>	<i>Lecturer: Ph.D., Associate Professor of the Radioengineering Department <b>Sergii Litvintsev</b> (<a href="mailto:Litvintsev.Sergii@LLL.kpi.ua">Litvintsev.Sergii@LLL.kpi.ua</a>), +38 094 821 37 72 Laboratory work: <b>Sergii Litvintsev</b>, Ph.D., Associate Professor, Radioengineering Department Associate Professor, Ph.D., Associate Professor of the Radioengineering Department <b>Olena Grygorenko</b></i>
<b>Course location</b>	<i>The course is available on the Sikorsky distance learning platform: <a href="https://do.ipu.kpi.ua/course/view.php?id=7167">https://do.ipu.kpi.ua/course/view.php?id=7167</a></i>

# 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 HTML documents and websites;
- the 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 the implementation of 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 acquired knowledge and skills, specialists will be able to solve professional tasks based on modern technologies and methods of building computer networks and create HTML documents and websites.

In accordance with the professional educational programs (PEP) of the first "bachelor's" level of higher education, after mastering the academic discipline, students should acquire **the** following program **competencies**:

### **General competencies (GC)**

GC-2 – Ability to apply knowledge in practical situations.

GC-4 – Knowledge and understanding of the subject area and understanding of professional activity.

## **Professional competencies (PC)**

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

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

PC-20 – Ability to select random signal parameters and optimize the communication channel according to the required criteria in the presence of noise and interference, perform engineering calculations of the main characteristics of random signals and devices for their processing.

## **Program learning results (PLR)**

According to the first "bachelor's" level of higher education, as a result of mastering the academic discipline, students must demonstrate the following **program learning results**:

PLR17 – understanding and compliance with domestic and international regulatory documents on the development, implementation, and technical operation of information and telecommunications networks, telecommunications and radio engineering systems;

PLR22 – Monitoring the technical condition of information and communication networks, telecommunications and radio engineering systems during their technical operation in order to identify deterioration in performance or failures, and systematically recording this through documentation.

PLR31 – Use Internet technologies to deploy computer communication networks of information radio systems.

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

In the structural-logical scheme of the professional educational program for training specialists of the first (bachelor's) level of higher education, the academic discipline "Fundamentals of Internet Technologies and Computer Networks" is included in the list of normative disciplines aimed at forming the professional competencies of a specialist.

*Prerequisites* – the course is specialized and is taught in the 7th semester of the 4th year of study in the educational program "Information and Communication Radio Engineering" of the first (bachelor's) level of higher education. To master this discipline, knowledge of the following disciplines is required: "Fundamentals of Electronic Communications and Radio Engineering Theory. Part 1. Fundamentals of Electronic Communications Networks," "Computer Science. Part 1. Fundamentals of Programming and Algorithms," "Computer Science. Part 2. Fundamentals of Computing," "Fundamentals of Metrology."

*Post-requisites* – knowledge gained in this discipline will ensure mastery of the following disciplines: "Signal Generation, Modulation, and Coding," "Mobile Communication Systems."

It is an integral part of the first (bachelor's) level of higher education.

## **3. Contents of the academic discipline**

### **I. Fundamentals of Computer Networks (lecture material)**

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

Topic 1.1. RSA

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 cable network

**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 address types
- Topic 8.2. Local addresses (MAC)
- Topic 8.3. Network addresses (IP)
- Topic 8.4. Address masks
- Topic 8.5. Character addresses (DNS)
- Topic 8.6. Calculating IPv4 subnets
- Topic 8.7. IPv6 and its comparison with IPv4

**Chapter 9.** Routing in IP Networks

- Topic 9.1. Basic concepts of routing
- Topic 9.2. Creating a route
- Topic 9.3. Selecting the optimal route
- Topic 9.4. Route-based forwarding
- Topic 9.5. Static routing

Topic 9.6. Dynamic routing

**Chapter 10.** ACL and AAA Technologies in IP Networks

Topic 10.1. ACL overview

Topic 10.2. Basic concepts and ACL operation mechanism

Topic 10.3. Basic ACL Settings and Applications

Topic 10.4. Basic Concepts of AAA

Topic 10.5. Typical AAA Architecture

Topic 10.6. AAA Implementation Protocol – RADIUS

**Chapter 11.** Time synchronization in IP networks

Topic 11.1. Overview of the NTP Protocol

Topic 11.2. Existing NTP Protocols

Topic 11.3. Comparison of NTP and SNTP Protocols

Topic 11.4. NTP Protocol Implementation

Topic 11.5. Vulnerabilities of the NTP Protocol

Topic 11.6. Recommendations for using the NTP protocol

## **II. Fundamentals of Internet Technologies (lecture material)**

**Section 12.** Fundamentals of HTML

Topic 12.1. What is HTML

Topic 12.2. How HTML works

Topic 12.3. Most commonly used HTML tags

Topic 12.4. General structure of an HTML file

Topic 12.5. Inline tags

Topic 12.6. Differences between HTML and HTML5

Topic 12.7. Pros and cons of HTML

Topic 12.8. How HTML, CSS, and JavaScript are related

Topic 12.9. Tool for creating HTML

**Chapter 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. Installing and configuring a web server

**Chapter 14.** FTP servers

Topic 14.1. What is an FTP server?

Topic 14.2. Why do you need an FTP server?

Topic 14.3. How the FTP protocol works

Topic 14.4. Installing and configuring an FTP server

Topic 14.5. How to connect to an FTP server

**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

## Module test

### Exam

#### III. Network technologies as a work tool

##### Section 16. Computer resources for general use in a local network

- Topic 16.1. Regular and "shared" computer folders
- Topic 16.2. Sharing computer folders
- Topic 16.3. Regular and "shared" computer printers
- Topic 16.4. Sharing computer folders

##### Section 17. E-mail as a work tool

- Topic 17.1. Rules for creating e-mail addresses
- Topic 17.2. Protocols for working with e-mail
- Topic 17.3. Mail client and online mail client
- Topic 17.4. Protecting e-mail from malicious information
- Topic 17.5. Additional features available on email servers

##### Section 18. RDP as a tool for work

- Topic 18.1. RDP for connecting to another computer
- Topic 18.2. How RDP differs from VPN
- Topic 18.3. RDP implementations and their use

##### Section 19. VPN as a tool for work

- Topic 19.1. VPN for connecting an external employee
- Topic 19.2. VPN for connecting two company branches
- Topic 19.3. VPN implementations and their use

##### Section 20. VM as a tool for work

- Topic 20.1. Overview of VM
- Topic 20.2. VM for creating a virtual computer
- Topic 20.3. VM implementations and their use

##### Chapter 21. NTP as an essential network tool

- Topic 21.1. Overview of NTP
- Topic 21.2. Default NTP Settings in Windows
- Topic 21.4. NTP servers in Ukraine
- Topic 21.5. Implementing your own NTP and using it

##### Section 22. Wireless networks and their configuration

- Topic 22.1. Use of frequency resources by Wi-Fi technology
- Topic 22.2. Calculating the signal level received by the receiver
- Topic 22.4. Fresnel zone and its calculation when building a wireless communication channel
- Topic 22.5. Wi-Fi router operating modes

## 4. Teaching materials and resources

Basic and additional literature (hereinafter referred to as literature) is used to prepare for lectures, laboratory classes, modular tests, self-study, etc. The literature that must be used to master the discipline is studied by students independently using Internet resources, on the Sikorsky distance learning platform using the Moodle platform. In the context of distance learning, literature that is available in electronic form on university and external media can be used.

### Basic literature

1. Tarnavskiy, 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. Tanenbaum A.S. *Computer Networks*, 4th ed. — Prentice Hall: New Jersey, 2003. — 384 p.
4. Mykityshyn A. G., Mytnik M. M., Stukhlyak P. D., Pasichnyk V. V. *Computer Networks* [textbook]. — Lviv: Magnolia 2006, 2013. 256 p.
5. Pogorily S. D., Kalita D. M. *Computer Networks. Hardware and Data Transmission Protocols: Textbook for Students of Higher Educational Institutions*, edited by O. V. Tretyak. Kyiv: Kyiv University, 2007. 455 p.

#### Additional literature

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.

#### Information resources

1. <https://2ip.ua/ua/> – online network tools.
2. <https://www.imena.ua/ua> – Ukraine's largest domain name registrar.

## Educational content

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

To study the academic discipline, 18 lectures and 9 laboratory classes are planned, during which students must complete modular tests, control tests after attending lectures, homework assignments, and defend their laboratory work after completion.

#### Lectures

No	Lecture topic and list of main questions
1	<p><i>Principles of network construction and elements</i>            RSA. The role of the network. Topology, network components. Wireless, mobile, global networks</p> <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>
2	<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> <p><i>Access methods</i>            General characteristics. CSMA/CD access method. CSMA/CA access method. TPMA access method. DPP access method</p>
3	<p><i>Computer resources for shared use on a local network</i>            Regular and shared computer folders. Sharing a computer folder. Regular and shared computer printers. Sharing a computer folder</p>
4	<p><i>Communication channels and lines</i>            The concept of a communication channel. Types of communication lines. Cable systems. Structured cabling system</p> <p><i>Communication line characteristics</i>            Types of characteristics. Amplitude-frequency characteristic. Bandwidth. Noise immunity. Data transmission reliability. Nyquist and Shannon formulas</p>

<b>5</b>	<p><i>Ethernet cable systems</i></p> <p>Types of Ethernet. 10BASE5 Ethernet. 10BASE2 Ethernet. 10BASE-T Ethernet. 10BASE-FL Ethernet. 100BASE-TX Ethernet. 100BASE-T4 Ethernet. 100BASE-FX Ethernet</p> <p><i>Addressing in IP networks</i></p> <p>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>
<b>6</b>	<p><i>E-mail as a work tool</i></p> <p>Rules for forming an e-mail name. Protocols for working with e-mail. Mail client and online mail client. Protecting e-mail from malicious information. Additional features available on mail servers</p>
<b>7</b>	<p><i>Routing in IP networks</i></p> <p>Basic routing concepts. Route creation. Selecting the optimal route. Route-based forwarding. Static routing. Dynamic routing</p>
<b>8</b>	<p><i>RDP as a tool for working</i></p> <p>RDP for connecting to another computer. How RDP differs from VPN. RDP implementations and their use</p>
<b>9</b>	<p><i>ACL and AAA technologies in IP networks</i></p> <p>Overview of ACL. Basic concepts and mechanism of ACL. Basic settings and application of ACL. Basic concepts of AAA. Typical AAA architecture. AAA implementation protocol – RADIUS</p>
<b>10</b>	<p><i>VPN as a tool for work</i></p> <p>VPN for connecting remote workers. VPN for connecting two company branches. VPN implementations and their use.</p>
<b>11</b>	<p><i>Time synchronization in IP networks</i></p> <p>Overview of the NTP protocol. Existing NTP protocols. Comparison of NTP and SNTP protocols. Implementation of the NTP protocol. Vulnerabilities of the NTP protocol. Recommendations for using the NTP protocol.</p>
<b>12</b>	<p><i>VM as a tool for work</i></p> <p>Overview of VM. VM for creating a virtual computer. VM implementations and their use.</p>
<b>13</b>	<p><i>HTML basics</i></p> <p>What is HTML. How HTML works. The most commonly used HTML tags. The general structure of an HTML file. Embedded tags. How HTML and HTML5 differ. The pros and cons of HTML. How HTML, CSS, and JavaScript are related. A tool for creating HTML</p>
<b>14</b>	<p><i>NTP as an essential network tool</i></p> <p>Overview of NTP. Default NTP settings in Windows. NTP servers in Ukraine. Implementing your own NTP and using it.</p>
<b>15</b>	<p><i>Web servers</i></p> <p>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 for web server deployment. Security of the OS on which the web server is installed. Installation and configuration of a web server</p> <p><i>FTP servers</i></p> <p>What is an FTP server. Why do you need an FTP server. How the FTP protocol works. Installation and configuration of an FTP server. How to connect to an FTP server</p>
<b>16</b>	<p><i>Wireless networks</i></p> <p>Use of frequency resources by Wi-Fi technology. Calculation of the signal level received by the receiver. Fresnel zone and its calculation when building a wireless communication channel. Wi-Fi router operating modes</p>
<b>17</b>	<p><i>Content management systems</i></p> <p>Content and content management. CMS content management systems. Technical structure</p>

	of CMS. CMS model. Document management system. Standards in CMS. Classification of CMS systems. Characteristics of CMS. Development of CMS. Commercial CMS systems. "Open" CMS systems.
<b>18</b>	<i>Modular test</i> Discussion of exam questions

### Laboratory classes

No.	Name of the topic and list of main questions
<b>1</b>	Providing your PC's resources to the local network
<b>2</b>	Providing external resources to the local network
<b>3</b>	Access to a remote workstation
<b>4</b>	Using VPN technology
<b>5</b>	Wi-Fi MT operating modes
<b>6</b>	Web server
<b>7</b>	WordPress CMS
<b>8</b>	Creating a business card website on WordPress
<b>9</b>	Defense of laboratory work and completion of missed assignments

### Distance learning platform

For better assimilation of the material of the academic discipline during the period of distance learning, e-mail, the Sikorsky distance learning platform using the Moodle platform, and the Google Meet and ZOOM platforms for online meetings are used, with the help of which:

- simplify the placement of methodological recommendations, teaching materials, literature, etc.;
- provide feedback to students on learning tasks and the content of the academic discipline;
- completed assignments are checked and evaluated;
- keep track of students' progress in the course, adherence to the schedule for submitting educational/individual assignments, and their assessment.

### 6. Self-study of students (SS)

Self-study includes: preparation for lectures and laboratory classes; self-assessment of acquired knowledge; study of recommended sources and literature; preparation for modular tests; preparation for homework assignments, preparation for exams, etc. ISW involves working through certain theoretical issues, the focus of which is provided during the lecture.

#### Preparation for lectures

To prepare for lectures, students must study the planned basic and supplementary literature and recommended sources. Before lectures, students must review the theoretical material that was presented in previous lectures or assigned in advance. Students are allocated approximately 1 hour for each topic of the discipline.

#### Preparation for laboratory classes

Students must prepare for laboratory classes in advance. Homework assignments for laboratory classes are provided in the relevant methodological guide. Assignments must be completed before the start of the relevant laboratory class.

### **Modular test (MT)**

Up to 2 hours are allocated for preparation for the MCT. The MCT covers questions on several sections of the module, for which lecture material has already been read and laboratory classes have been completed.

### **Home control work (HCW)**

In order to better assimilate the course material, a home control work is planned, which is presented in the form of an analysis and calculation of a real network. To prepare for the HCT, students should use the recommended literature, lecture notes, and methodological guidelines. Individual assignments for the HCT are given by the instructor, who also sets deadlines for submission. The HCT includes:

1. Designing the network structure.
2. Calculations of the subnetwork when distributing the 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. Creating a business card website.
6. Checking the functionality of the business card website in the created local network.

### **Exam**

The exam is held during the semester control period (session), at the end of the academic semester after students have written their modular tests and homework control works. Based on the results of the rating points earned during the semester or by decision of the teacher, the student takes the exam. Six hours of class time are allocated for exam preparation. The list of questions corresponds to the questions that were covered in lectures and laboratory classes. During the distance learning period, the exam can be conducted according to the class schedule using Moodle and the Google Meet and ZOOM online meeting platforms.

## **Policy and control**

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

#### **Class attendance**

Attendance at lectures and laboratory classes — in accordance with the Regulations on the Organization of the Educational Process at Igor Sikorsky KPI. At least once every two weeks, the instructor conducts consultations on various issues of the credit module. During consultations, the instructor can 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.

#### **Rules for completing assignments**

When studying the material of the course "Fundamentals of Internet Technologies and Computer Networks," students:

- 1) during lectures:
  - take periodic quick tests of residual knowledge from sections of the course, which may include creative tasks on topics not covered in lectures, or quick test tasks (lasting 5–10 minutes using tests on the Sikorsky platform);
  - complete modular tests using the Sikorsky platform;
- 2) in laboratory classes:

- prepare homework assignments based on their own tasks based on the study of sources and literature;
- complete mandatory assignments in accordance with the methodological guide;
- save the results obtained for further preparation of reports on the results of laboratory work.

Tasks and materials for quick tests/creative assignments are developed by the instructor based on the course material and submitted in Google Classroom or in another form.

### **Rules of conduct in class**

When studying the material of the academic discipline "Fundamentals of Internet Technologies and Computer Networks," students listen attentively to the lecturer during lectures and, if necessary, write down important information, periodically complete express tests in written form (within 5–10 minutes) and modular tests (MTR) using the Sikorsky platform. Dialogue between students and the lecturer in the form of questions and answers is permitted.

During laboratory classes, students complete mandatory assignments. Student work involves participation in interactive forms of classroom organization (answering questions posed by the instructor or students). Each student is expected to be prepared for all questions in the laboratory class, supplement the reports of other students, and express their own opinion during discussions of issues that arise during the completion of tasks. Students are allowed to use their own written notes and summaries. The use of laptops, tablets, and phones for educational purposes is permitted. At the same time, students should try to express their own opinions rather than read out other people's texts. The teacher critically analyzes the presentations, comments on mistakes, and moderates discussions between students.

The topics of lectures and laboratory classes are covered in the course syllabus, which is available on the Electronic Campus, the website of the Radio Engineering Department, and the Sikorsky platform (Moodle, Google Classroom).

### **Bonus and penalty points**

*Bonus points.* Students are encouraged to independently study topics that are not included as mandatory in the course of this subject (use of such technology when performing laboratory work +5 points maximum).

Student participation in solving problems that many students encounter when performing laboratory tasks is encouraged (+1 point for solving one problem).

Students are encouraged to create new teaching materials (new test questions, suggestions for improvement, etc.) and to find errors in existing teaching materials (+1 point for each suggestion/error found).

### **Missed tests**

The result for a student who did not attend the assessment is zero. If a student misses an assessment for a valid reason, they are given the opportunity to complete it (do the lab work) in the presence of the instructor. If the absence was without a valid reason, the issue of making up the assessment is decided with the instructor in consultation with the department management. A missed exam 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 exam, they must take it during an additional session.

### **Announcement of test results**

The defense of the completed section of the HCW 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 upon 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 conduct

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>.

## 8. Types of control and rating system for assessing learning outcomes (RSA)

### Ongoing assessment

Current control is carried out during classes and aims to check the level of students' preparation for classes. During laboratory classes, students are surveyed on topics related to the subject. Modular test is carried out once per semester to check residual knowledge of the most important section of the academic discipline. Express control in the form of tests is carried out after lectures.

### Calendar control

Calendar control is carried out twice per semester to monitor the current status of syllabus requirements. There are two possible results of calendar control: certified (c) and not certified (n/c). The result depends on the number of points scored at the time of calendar control in accordance with the requirements of Igor Sikorsky KPI.

### Semester control

Semester control is considered to be an exam.

### Assessment and control measures

A student's grade for a course consists of points earned for:

- 1) assessment of residual knowledge by completing express test tasks based on lecture materials using tests on the Sikorsky platform;
- 2) work in 8 laboratory classes;
- 3) modular tests
- 4) a take-home test

Information on the above points, summarized in the table

No.	Control measure	Maximum score	Number	Total
1	Attendance at lectures (test after lecture)	0.5	18	9
2.	Work in laboratory classes	8	8	64
3.	Modular tests (MT)	3	4	12
4	Home test (HT)	15	1	15
5	Bonuses	10	1	10
6.	Exam (if you did not score 60)	40	1	40
	Total without bonuses			100
	Total with bonuses			11

In order to receive the highest rating, students must actively participate in laboratory classes, actively supplement the answers of other students, clearly and logically express their own position on discussion issues, and complete MT and express controls in a timely manner. Students are given a one-time opportunity to complete MT and express controls.

The following factors lead to a decrease in a student's rating: failure to complete MT and express controls; inadequate preparation for laboratory classes; inaccuracies, incompleteness, errors in answers, or reliance on unreliable sources.

The instructor evaluates the student's work at each laboratory class and enters the scores for the work and results of the MT and express controls into the "Current Control" module of the Electronic Campus. The results of the first and second calendar controls depend on the student's current rating and are entered by the teacher into the "Calendar Control" module of the Electronic Campus in the eighth and sixteenth weeks of study, respectively.

The student may appeal the teacher's grade by submitting a complaint to the teacher no later than the day after the student has been informed of the grade given by the teacher. The complaint will be considered in accordance with the procedures established by the university.

### **Conditions for admission to semester control**

A minimum of 40 points and a grade of at least "sufficient" on the coursework.

### **Table of correspondence between rating points and grades on the university scale:**

<b>Number of points</b>	<b>Grade</b>
100-95	Excellent
94	Very good
84	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)**

### **Recommendations for students**

While attending lectures, students should write down key terms and concepts, note the main events of the topic, and summarize the generalizations and conclusions made by the instructor. This material will be useful when preparing for laboratory classes, MT, HCW, and quick tests.

When preparing for a laboratory class, students must study the lecture material on a specific topic and, preferably, familiarize themselves with additional online resources. If any questions arise or anything is unclear, students should discuss them with the instructor. During the laboratory class, each student should try to master the practical skills that can be mastered on their own. Students should not refuse to answer the teacher's questions. Even if a student does not know the answer, it is advisable to try to answer, express their opinion based on their own knowledge, experience, logic of the question, etc. However, it is important to remember that not knowing the subject matter is a significant shortcoming in a student's work and will negatively affect their overall grade. A responsible attitude toward preparing for each lab session allows students not only to properly master the material, but also to save effort when taking semester exams.

Students may be credited for a course topic if they have certificates of completion of distance or online courses on the relevant subject.

### **Distance learning**

Synchronous and asynchronous distance learning is possible using video conferencing platforms (Google Meet, Zoom, etc.) and the Sikorsky distance learning educational platform (Moodle).

### **Inclusive learning**

Inclusive learning is permitted.

Work program for the academic discipline (syllabus):

**Prepared by:** Associate Professor of the Radioengineering Department, Sergii Litvintsev

**Approved by:** Radio Engineering Department (Minutes No. 06/2025 dated 06/17/2025).

**Approved by:** REF Academic Council (Minutes No. 06/2025 dated 26.06.2025).

## 10. Appendix A

### RATING SYSTEM FOR ASSESSING LEARNING OUTCOMES

in the academic discipline  
BASICS OF INTERNET TECHNOLOGIES AND COMPUTER NETWORKS  
first (bachelor's) level of higher education, bachelor's degree

form of study

*full-time*

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1. The student's grade for the academic discipline consists of points awarded for:

- assessment of residual knowledge in 18 lectures;
- work in 8 laboratory classes;
- modular tests (MT);
- home control work (HCW).

Distribution of study time by type of class and assignment from the credit module according to the working curriculum:

Semester	Teaching time		Distribution of teaching hours			Control measures		
	Credits	academic hours	Lectures	Lab work	SS	MT	HCW	Semester assessment
7	4	72	36	36	48	4	1	exam

A student's credit module rating consists of points awarded for:

- 1) Passing tests after attending lectures — maximum number of points 9 for 18 lectures.
- 2) Completion and defense of 8 laboratory works, maximum number of points —  $8 \times 8 = 64$ ;
- 3) Completing modular tests (MT), maximum number of points — 12 (3 points for each of the 4 MT);
- 4) Completion and defense of a home assignment (HCW), maximum number of points — 15.
- 5) Bonus points — maximum number of points — 10.

#### Rating point system

##### *1. Testing of knowledge level after each lecture*

1.1. Testing is conducted immediately after the lecture. Testing time — 72 hours.

1.2. Testing is conducted by taking tests in the Moodle system on the Sikorskii platform (<https://do.ipk.kpi.ua>).

1.3. The questions in the tests correspond to the topic of the lecture.

1.4. The maximum number of points for one lecture is 0.5 points.

##### *2. Laboratory work*

2.1. Completion of homework on laboratory work — 1 point (availability of the homework file or its presence in the report when performing offline).

2.2. Completion of laboratory work.

— When performing the work in person: 3 points for all completed and working tasks. Confirmation of completion is provided by screenshots in the report.

— When performing the work online: 1 point for one mandatory task (availability of the task file).

2.3. Preparation of a report on the results of the laboratory work — maximum possible number of points — 1 point.

2.4. Defense of laboratory work (there is an option to defend through testing):

– complete mastery of the material during the defense (at least 90% of the required information) — 4 points;

– partial mastery of the material (at least 80%) — 3 points;

– partial mastery of the material (at least 70%) — 2 points;

– satisfactory mastery of the material (at least 60%) — 1 point;

– unsatisfactory mastery of the material (less than 60%) — 0 points;

Defense on the day of completion or at the next class — +1 point for one laboratory work (bonus).

The laboratory work is considered successfully defended if the student scores 5 points out of a possible 8. If the student scores less than 5 points, the work must be defended again.

### *3. Modular test (MT)*

MCTs are conducted after the completion of individual sections of lectures by means of testing in the Moodle system. The maximum number of points is 12 points, calculated as 3 points for 4 MCTs.

### *4. Home control work (HCW)*

The HCW assessment consists of three parts:

- Calculations according to the assignment (max. 7 points)
- HCW formatting (max 3 points)
- Defense of the final project (max 5 points) — there is an option to defend via testing
- Bonus (max 4 points)

*Completion of the final project:*

– the assignment for the final project corresponds to the module topic;

– the HCW is completed during the semester;

– the teacher determines the deadline for submitting the HCW for review;

– The date of submission of the HCW is considered to be the date when a hard copy of the HCW is handed over to the teacher, in which at least 90% of the task has been completed and the work has a finished appearance and layout.

*Compliance with the assigned HCW task:*

– complete and accurate solution of the task — 7 points;

– partial solution of the task — 5 points;

– incomplete solution of the task — 3 points;

– task not completed or does not correspond to the approved topic — 0 points.

*Design and structure:*

- full compliance with the design requirements and the presence of all necessary structural elements — 3 points;
- design with minor violations or not all structural elements present — 2 points;
- design with violations, recommended structure violated, minor grammatical and stylistic errors — 1 point;
- the final project is not formatted or there is a complete lack of structure, with a significant number of grammatical and stylistic errors — 0 points.

*Originality of the solution provided:*

- the solution provided was not discussed in the lecture course and was not proposed as a solution option in practical classes — 4 points (bonus).

*Defense of the final project:*

- complete mastery of the material presented in the HCW, understanding of its essence — 5 points;
- partial mastery of the material (more than 75%) or incomplete understanding of the issues covered — 4 points;
- poor command of the material (more than 60%) or lack of understanding of the essence of the issues covered — 3 points;
- unsatisfactory mastery of the material (less than 60%) and lack of understanding of the essence of the issues covered — 0 points.

The HCW is considered passed if it receives at least 11 points.

*5. Bonus and penalty points*

*Penalty points (not taken into account during wartime):*

- late defense of laboratory work — -1 point for each;
- late submission of the final coursework for review — up to -10 points (-1 point for each day of delay).

*Bonus points:*

- timely defense of laboratory work — 1 point if the work is defended on the day of completion or on the next scheduled class;
- early submission of coursework for review — 2 points if the coursework is submitted for review one week before the deadline or earlier;
- original solution of the HCW;
- original solution of laboratory work, or solution of a task in addition to the one provided;
- proposed your own version of tests;
- proposed your own version of the HCW.

A student cannot receive more than 10 penalty points or 10 bonus points.

The maximum number of points is 100. Completion of coursework and defense of all laboratory work is a prerequisite for admission to the exam.

Students who have earned more than 60 points during the semester are entitled to receive an "automatic" grade; points are converted into grades according to the table.

Students who have not earned 40 points during the semester are considered to have failed to complete the course load and are not admitted to the exam.

Students who have earned less than 60 points but more than 40, as well as those who want to improve their grade, take the exam. In this case, points for passing the exam are added to the HCW points, and this rating is final, i.e., during the exam, it is possible to earn fewer points than before.