



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

Curriculum of the academic discipline (Syllabus)

Course details

Level of higher education	<i>First (bachelor's)</i>
Field of knowledge	<i>G Engineering, manufacturing, and construction</i>
Special	<i>G5 Electronics, electronic communications, instrument engineering, and radio engineering</i>
Educational program	<i>Information and communication radioengineering</i>
Status of discipline	<i>Compulsory for professional training (full-time study) Compulsory professional training (full-time accelerated learning)</i>
Form of study	<i>Full-time (daytime)</i>
Year of training, semester	<i>4th year, 7th semester (full-time study) 2nd year, 4th semester (full-time accelerated training)</i>
Scope of the discipline	<i>Total: 5 ECTS credits / 150 hours Lectures: 30 hours. Computer workshops: 14 hours. Laboratory classes: 32 hours. Self-study by students: 74 hours.</i>
Semester assessment/assessment measures	<i>Modular tests, calculation work, final test Ongoing assessment/defense of laboratory work</i>
Class schedule	<i>Lectures (once a week starting from week 1 Computer workshops (once every two weeks after the lecture) Laboratory work (once every two weeks, preferably after the lecture)</i>
Language of instruction	<i>Ukrainian</i>
Information about the course director/teachers	<i>Lecturer: Ph.D., Associate Professor of the RED Sergii Litvintsev (Litvintsev.Sergii@LLL.kpi.ua), +38 094 821 37 72 Laboratory work: Sergii Litvintsev, Ph.D., Associate Professor, RED Associate Professor, Ph.D., Associate Professor of the Radio Engineering Department Olena Grygorenko</i>
Course location	<i>The course is available on the Sikorsky distance learning platform: https://do.ipu.kpi.ua/course/view?id=7167</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 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.

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 the case of processing results or random signals.

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

Professional competencies (PC)

PC-8 – Willingness 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 – Monitor 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 record this information in documentation.

PLR30 – 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 academic discipline 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 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

Section 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. Address masks
- Topic 8.5. Character addresses (DNS)
- Topic 8.6. Calculating IPv4 subnets
- Topic 8.7. IPv6 and its comparison with IPv4

Section 9. Routing in IP Networks

- Topic 9.1. Basic routing concepts
- 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. Implementation of the NTP Protocol
- 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. Installation and configuration of 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

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 functions available on mail 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

Chapter 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 its use

Chapter 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

To prepare for lectures, laboratory classes, modular tests, self-study, etc. , basic and additional literature (hereinafter referred to as literature) is used. 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, 15 lectures, 7 computer workshops, and 8 laboratory classes are planned, during which students must complete modular tests, control tests after attending lectures, calculation work, and defend laboratory works after their completion.

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> <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>
5	<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> <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>
6	<p><i>Routing in IP networks</i> Basic concepts of routing. Route creation. Selecting the optimal route. Route-based transmission. Static routing. Dynamic routing</p>
7	<p><i>ACL and AAA technologies in IP networks</i> ACL overview. Basic concepts and mechanism of ACL operation. Basic ACL settings and applications. Basic AAA concepts. Typical AAA architecture. AAA implementation protocol – RADIUS</p>
8	<p><i>RDP as a tool for working</i> RDP for connecting to another computer. How RDP differs from VPN. RDP implementations and their use</p> <p><i>VPN as a tool for work</i></p>

	VPN for connecting remote workers. VPN for connecting two company branches. VPN implementations and their use
9	<i>Time synchronization in IP networks</i> 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
10	<i>VM as a tool for work</i> Overview of VM. VM for creating a virtual computer. VM implementations and their use
11	<i>HTML basics</i> What is HTML. How HTML works. The most commonly used HTML tags. The general structure of an HTML file. Built-in tags. How HTML and HTML5 differ. The pros and cons of HTML. How HTML, CSS, and JavaScript are related. A tool for creating HTML
12	<i>NTP as an essential network tool</i> Overview of NTP. Default NTP settings in Windows. NTP servers in Ukraine. Implementing your own NTP and using it.
13	<i>Web servers</i> Basic functions of web servers. Criteria for selecting web servers. Overview of web servers (Apache, IIS, httpd, Google Web Server). Web server security and causes of vulnerability. Planning web server deployment. Security of the OS on which the web server is installed. Installation and configuration of a web server <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
14	<i>Wireless networks</i> 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
15	<i>Content management systems</i> Content and content management. CMS content management systems. Technical structure 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

Computer workshops

No.	Name of the topic and list of main questions	Hours
1	Basics of computer network documentation Why. What to draw with	2
2	Basics of computer network documentation Network structure diagram	2
3	Basics of computer network documentation L3 network diagram	2
4	Basics of computer network documentation	2

	L2 network diagram	
5	Basics of computer network documentation Equipment placement in a rack	2
6	Basics of computer network documentation What is an IP plan	2
7	Basics of computer network documentation Description and storage of equipment settings	2

Laboratory classes

No.	Name of the session topic and list of main questions	Hours
1	Providing your PC's resources to the local network	4
2	Providing external resources to the local network	4
3	Access to a remote workplace	4
4	Use of VPN technology	4
5	Wi-Fi MT operating modes	4
6	Web server	4
7	WordPress CMS	4
8	Creating a business card website on WordPress	4

Distance learning platform

For better assimilation of the material of the academic discipline during the period of remote work, 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, training materials, literature, etc.;
- provide feedback to students on learning tasks and the content of the academic discipline;
- completed assignments are checked and evaluated;
- keeping track of students' progress in the course, adherence to the schedule for submitting educational/individual assignments, and their assessment.

6. Self-study of the student (SS)

Self-study includes: preparation for lectures, computer workshops, and laboratory classes; self-assessment of acquired knowledge; study of recommended sources and literature; preparation for modular test; preparation for calculation work, preparation for tests, etc. SRW 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 computer workshops

Students must prepare for computer workshops in advance. They must have a workspace and a working computer/laptop with a power supply. Internet access is required if classes are held online.

Preparation for laboratory classes

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

Modular test (MT)

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

Calculation work (CW)

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

Examination

The test is conducted during the semester control period (test week), at the end of the academic semester after students have written their modular tests and calculation works. Based on the results of the rating points earned during the semester or by decision of the teacher, the student writes a test paper. Six hours of class time are allocated for preparation for the exam. The list of questions corresponds to the questions that were covered in lectures and laboratory classes. During the period of distance learning, 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 is 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 a modular test 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 (MT) using the Sikorsky platform. Dialogue between students and the teacher in the form of questions and answers is allowed.

During laboratory classes, students complete mandatory assignments. Student work involves participation in interactive forms of classroom organization (answering questions asked by the lecturer or students at). 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 Radioengineering Department, and the Sikorsky platform (Moodle, Google Classroom).

Incentive and penalty points

Bonus points. Students are encouraged to independently study topics that are not included as mandatory in the course (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 control measures

The result for a student who did not attend the test is zero. If a student misses a test for a valid reason, they are given the opportunity to make it up (complete the laboratory 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 CW 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>.

Ethical standards

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

Ongoing assessment is carried out during classes and aims to check the level of student 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 a final test.

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) calculation work

Information on the above points is summarized in the table

No	Test	Maximum score	Number	Total
1	Attendance at lectures (test after lecture)	0.4	15	6
2.	Work in computer workshops	1	7	7
3.	Work in laboratory classes	8	8	64
4.	Modular test (MT)	4	2	8
5	Calculation work (CW)	15	1	15
6.	Bonuses	10	1	10
7.	Credit (if you did not score 60)	40	1	40
	Total without bonuses			10
	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 instructor 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" for the coursework.

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

Number of points	Grade
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

During lectures, students should write down key terms and concepts, note the main points of the topic, and summarize the conclusions made by the instructor. This material will be useful when preparing for lab classes, MT, CW, 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 resources on the Internet. If questions arise or unclear points are identified, they should be discussed with the teacher. During the lab session, 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):

Compiled by: Associate Professor of the Radioengineering Department, Sergii Litvintsev

Approved by: the Radioengineering Department (Minutes No. 06/2025 dated June 17, 2025).

Approved by: the Academic Council of the REF (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

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

- assessment of residual knowledge in 15 lectures;
- work on 7 computer workshops;
- work in 8 laboratory classes;
- modular tests (MT);
- calculations (CW).

Distribution of teaching 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	Computer workshops	Lab workshops	SS	MT	CW	Semester assessment
7 4	5	76	30	14	32	74	2	1	exam

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

- 1) Taking tests after attending lectures — maximum number of points 6 for 15 lectures.
- 2) Completion and presentation of 7 computer workshops — $7 \times 1 = 7$ points;
- 3) Completing and defending 8 laboratory works, maximum number of points — $8 \times 8 = 64$;
- 4) Completing modular tests (MT), maximum number of points — 8 (4 points for each of 2 MT);
- 5) Completion and defense of a calculation work (CW), maximum number of points — 15.
- 6) 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. Computer workshop

- 2.1. Preparing the workplace for the computer workshop.
- 2.2. Completing the computer workshop.

— When performing the work in person: 1 point for all completed and working tasks. Screenshots in the report serve as confirmation of completion.

3. Laboratory work

3.1. Completing homework on laboratory work — 1 point (the presence of a homework file or its presence in the report when working offline).

3.2. Completion of laboratory work.

— When performing 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 (presence of a file for the task).

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

3.4. 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 lab 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.

4. Modular test (MT)

The MCT is conducted after the completion of the lecture course by means of testing in the Moodle system. The maximum number of points is 8 points, calculated as 4 points for each of the 2 MCTs.

5. Calculation work (CW)

The CR assessment consists of three parts:

- Calculations according to the assignment (max. 7 points)
- Presentation of the CR (max 3 points)
- Defense of the research paper (max 5 points) — there is an option to defend it through testing
- Bonus (max 4 points)

Completion of the CW:

– the assignment for the CW corresponds to the module topic;

– the CW is completed during the semester;

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

– the date of submission of the CW is considered to be the date when a hard copy of the CW 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 CW task:

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

– partial solution of the task — 5 points;

– incomplete solution of the task — 3 points;

– the assignment is 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;
- PP 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 research paper:

- complete mastery of the material presented in the CW, 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 CW 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 CW 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 at the next scheduled class;
- early submission of CW for review — 2 points if the CW is submitted for review one week before the deadline or earlier;
- original solution of the CW;
- 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 CW.

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

The maximum number of points is 100. Completion of the CW 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 final 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 CW points, and this rating is final, i.e., during the exam, it is possible to earn fewer points than before.