Національний технічний університет України
«КИЇВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ
імені ІГОРЯ СІКОРСЬКОГО»

Department of Applied Radio Electronics

[RE-340] COMMUNICATION MEANS IN INTELLIGENT RADIO ELECTRONIC SYSTEMS

Curriculum of the academic discipline (Syllabus)

Course details

Level of higher education	First (bachelor's)
Field of knowledge	G Engineering, Manufacturing and Construction
Specialization	G5 Electronics, Electronic Communications, Instrument Engineering and Radio Engineering
Educational program	Intelligent technologies of radio electronics
Discipline status	Regulatory
Form of higher education	Full-time
Year of training, semester	4th year, fall semester
Scope of the discipline	5 credits (Lectures 30 hours, Practical work 30 hours, Laboratory work 16 hours, Independent work 74 hours)
Semester control/control measures	Exam
Class schedule	https://schedule.kpi.ua
Language of instruction	Ukrainian
Information about the course coordinator/teachers	Lectures: A. V. Movchanuk, Practical classes: N. V. Yezersky
Course location	

Course program

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

The discipline develops the following general competencies (GC):

GC 01 Ability to think abstractly, analyze, and synthesize

GC 02 Ability to apply knowledge in practical situations.

GC 04 Knowledge and understanding of the subject area and understanding of professional

activity.

GC 07 Ability to learn and master modern knowledge.

GC 08 Ability to identify, pose, and solve problems.

Professional competencies (PC)

PC 01 Ability to understand the essence and significance of information in the development of a modern information society

PC 03 Ability to use basic methods, means, and tools for obtaining, transmitting, processing, and storing information.

PC 04 Ability to perform computer modeling of devices, systems, and processes using universal application software packages.

PC 05 Ability to use regulatory and legal documentation related to information and telecommunications networks, telecommunications and radio engineering systems (laws of Ukraine, technical regulations, international and national standards, recommendations of the International Telecommunication Union, etc.) to solve professional tasks

PC 06 Ability to perform instrumental measurements in information and telecommunications networks, telecommunications and radio engineering systems.

PC 09 Ability to accept and master new equipment in accordance with current standards.

PC 10 Ability to install, debug, configure, adjust, test, and commission telecommunications and radio engineering structures, facilities, and equipment.
PC 12 Ability to perform work related to managing information and telecommunications network traffic flows

PC 14 Readiness to study scientific and technical information, domestic and foreign experience on the subject of investment (or other) projects in the field of telecommunications and radio engineering

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

PC 16 Ability to apply standard calculation methods in the design of telecommunications and radio engineering devices and systems

PC 20 Ability to select methods and means of information processing using intelligent technologies

PC 21 Ability to apply a comprehensive approach to the development of radio-electronic equipment

PC 22 Ability to select and critically evaluate and choose technical solutions at all stages of the development and design of radio-electronic equipment using intelligent technologies

Program learning outcomes (PLO):

PLO 01 Analyze and make informed decisions when solving specialized tasks and practical problems in telecommunications and radio engineering, which are characterized by complexity and incomplete certainty of conditions

PLO 02 Apply the results of personal search and analysis of information to solve qualitative and quantitative problems of a similar nature in information and communication networks, telecommunications and radio engineering systems;

PLO 04 Explain the results obtained from measurements in terms of their significance and relate them to the relevant theory.

PLO 07 Competently apply terminology in the field of telecommunications and radio engineering.

PLO 14 Apply understanding of the basic properties of the component base to ensure the quality and reliability of telecommunications and radio engineering systems and devices.

PLO 15 Apply an understanding of the means of automation of design and technical operation of telecommunications and radio engineering systems in professional activities.

PLO 16 Apply an understanding of the basics of metrology and standardization in the field of telecommunications and radio engineering in professional activities.

PLO 18 Find, evaluate, and use information from various sources necessary to solve professional tasks, including reproducing information through electronic search.

PLO 20 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, telecommunications, and radio engineering systems.

PLO 22 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 by means of documentation.

PLO 26 Design and implement elements of intelligent technologies using software-configurable equipment

PLO 28 Apply methods and means of influencing the parameters of the physical environment;

PLO 30 Apply a comprehensive approach to the design of telecommunications and radio-electronic equipment

PLO 32 Apply the basic principles of diagnostics, control, and testing of radio-electronic equipment at the main stages of production using intelligent technologies

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

To master this discipline, students must have knowledge of such disciplines as: Communication methods in intelligent radio-electronic systems. It is also necessary to have skills in using the Matlab application package.

Prerequisites for the discipline are: Information protection in intelligent radio-electronic systems and Computer modeling in intelligent systems.

3. *Contents of the discipline*

Lectures:

Topic 1: Radio frequency spectrum

Topic 2: Communication channels. Optical, wired, wireless, optical, fiber optic, acoustic.

Topic 3: Generalized structure of a communication device. Primary source, matching node, modulator, signal energy converter to communication line signal.

Topic 4: Signal energy converters into communication line signals. Antennas, bus formers, lasers + photodiodes, acoustic converters.

Topic 5: Analog modulators. Phase, frequency, single sideband, double sideband, suppressed carrier.

Topic 6: Analog demodulators

Topic 7: Signal shapers (amplifiers) and output stages of radio transmitters. Frequency synthesizers. Amplification classes, matching with the source, matching with the load, summers, power dividers.+Block diagrams

Topic 8: Pre-detector path of analog radio receivers. Input devices, frequency converters (diode, transistor, hybrid), selective amplifiers.+Block diagrams

Topic 9: Digital modulators and demodulators.

Topic 10: Features of digital transmitter design.

Topic 11: Pre-detector path of digital radio receiving devices, SDR Radio: transmitters/receivers, design

principles, hardware.

Topic 12: Radio transmitters of the optical frequency range. Single-mode, multi-mode fiber optics.

Topic 13: Radio receivers in the optical frequency range

Topic 14: Radio transmitters in the acoustic frequency range

Topic 15: Radio receivers in the acoustic frequency range

Laboratory work:

Laboratory work No. 1: SDR receivers

Laboratory work No. 2: Narrowband FM transceivers

Laboratory work No. 3: Selective amplifiers

Laboratory work No. 4: Measuring receiver characteristics.

Laboratory work No. 5: Measuring transmitter characteristics.

Laboratory work No. 6: Matching twisted pairs

Practical training topics:

1. Calculation of low-frequency receiver input devices
2. Calculation of input devices for medium frequency receivers
3. Calculation of high-frequency receiver input devices
4. Calculation of input devices for the optical frequency range
5. Calculation of input devices for the acoustic frequency range
6. Calculation of output stages of low-frequency transmitters
7. Calculation of output stages of medium frequency transmitters
8. Calculation of output stages of high-frequency transmitters
9. Calculation and selection of antenna devices
10. Calculation of microstrip transmission lines

4. *Training materials and resources*

1. Fundamentals of radar. *Grundlagen der Radartechnik*. URL: https://www.radartutorial.eu/07.waves/wa04.uk.html .

2. Mogilevich D., Golovin Yu. BASICS OF RADIO COMMUNICATION THEORY THEORETICAL BASICS AND PRACTICAL ASPECTS. 2nd edition. Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2023. 248 p.

3. Kobyakov, O., Kulik, I. THEORY OF ELECTRICAL COMMUNICATION Lecture notes. *SumDU Repository*.
URL: https://essuir.sumdu.edu.ua/server/api/core/bitstreams/5cb7a448-93f3-485b-b54c-50d0065f5dab/content.

Educational content

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

Lectures.

The purpose of lectures is to help students understand the interrelationships between factors that influence the design of information transmission networks.

Practical classes.

The purpose of practical classes is to perform practical calculations and modeling of communication channels discussed in lectures.

Laboratory classes.

To familiarize students with the measurements involved in the implementation of data transmission networks.

6. *Independent work*

Students must prepare for lectures and laboratory classes in advance. Homework assignments for practical and laboratory classes must be completed before the next class.

Policy and control

7. *Academic discipline policy (educational component)*

Class attendance

Attendance at lectures, practical classes, and laboratory classes is in accordance with the "Regulations on the Organization of the Educational Process at Igor Sikorsky KPI." During consultations, the instructor may provide assistance in studying the material from 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, tests, and calculations.

Missed tests

The result for a student who did not attend a test is zero. If a test is missed for a valid reason, the student is given the opportunity to complete it (write a test, complete laboratory work) in the presence of the teacher. If the absence occurred without a valid reason, especially with regard to laboratory work, the issue of completing it is decided with the teacher in agreement with the department management.
A missed exam is not counted regardless of the reasons for the absence; in this case, the student receives a "did not appear" mark if they are eligible to take the exam and must take the exam during an additional session.

Announcement of test results

The results of the MCR are announced to each student individually. When communicating in person, at the student's request, they can receive an explanation showing their grade according to specific assessment criteria.

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 information, 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.

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 control measures and expect that it will be considered in accordance with pre-defined procedures.

Students have the right to appeal the results of control measures, but they 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)*

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

Number of points	*Grade*
10	Excellent
94	Very good
84	Good
74-65	Satisfactory
64-60	Sufficient
Less than 60	Unsatisfactory
Conditions for admission not met	Not admitted

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

Practical classes use modeling in the Matlab software package. If desired, students may use other software packages such as Mathcad, or based directly on programming languages, but must prove the feasibility of their calculations.

The models used in laboratory work are various types of analog and SDR receivers. Laboratory equipment includes AM and FM oscillation generators.

Description of material, technical, and information support for the discipline

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Work program for the academic discipline (syllabus):
Compiled by Movchanuk A. V.; Yezersky N. V.;
Approved by the PRE Department (Minutes No. 06/2025 dated 06/25/2025)
Approved by the methodological commission of the faculty/research institute (protocol No. 06/2025 dated 26.06.2025)