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

Department of Applied Radio Electronics

[RE-212 PRE] DIPLOMA DESIGN

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 in Radio Electronics
Discipline status	Regulatory
Form of higher education	Full-time
Year of training, semester	4th year, spring semester
Scope of the discipline	8 credits (lectures, practical classes, laboratory classes, independent work: 180 hours)
Semester control/control measures	Defense
Class schedule	https://schedule.kpi.ua
Language of instruction	Ukrainian Information
about course coordinator/teachers	SRS: Shulga A. V.
Course location	

Curriculum

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

Description of the discipline. During the diploma project, students prepare a certification work—a diploma project, which is the final stage of bachelor's degree education. Based on the results of the preparation and defense of the diploma project, the examination committee decides on awarding the student the appropriate qualification and educational degree.

Subject of the academic discipline: thesis project/work.

Interdisciplinary connections. The diploma project is based on all disciplines studied as part of the bachelor's degree curriculum.

The purpose of the academic discipline. To develop students' abilities to design software that meets the established initial data; to perform technical and economic justification of decisions made; make decisions that correspond to the latest achievements in science and technology; apply modern methods of analysis and development of software components; reasonably select methods and conduct research/experiments, analyze the results obtained; analyze the quality of the created software; effectively use modern information technologies; execute design and engineering documentation in accordance with regulatory requirements.
Mastering the methodology of creative solutions (solving) of modern problems (tasks) of a scientific and/or applied nature based on the knowledge and professional skills acquired in accordance with the requirements of higher education standards.

The discipline develops the following competencies :

GC 02 - Ability to apply knowledge in practical situations.

GC 03 - Ability to plan and manage time.

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

professional activity.

GC 06 - Ability to work in a team

GC 07 - Ability to learn and master modern knowledge.

GC 08 - Ability to identify, set, and solve problems.

GC 09 - Skills for safe activity

GC 10 - Commitment to environmental protection.

GC 11 - Ability to exercise one's rights and responsibilities as a member of society, to understand the values of a civil (free democratic) society and the need for its sustainable development, the rule of law, and the rights and freedoms of individuals and citizens in Ukraine.

PC 02 - Ability to solve standard tasks of professional activity based on information and bibliographic culture using information and communication technologies and taking into account the basic requirements of information security

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 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 07 - Readiness to monitor compliance with and ensure environmental safety.

PC 08 - Readiness to promote the implementation of promising technologies and standards.

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 facilities, equipment, and devices.

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

PC 13 - Ability to organize and implement occupational health and safety measures in the process of operation, maintenance, and repair of information and telecommunications networks, telecommunications and radio engineering systems.

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 17 - Ability to participate in design and technological preparation, implementation into production, and support of the production of radio-electronic equipment.

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

PC 25 - Ability to make informed choices regarding CAD systems for analysis, calculation, optimization of the output characteristics of mathematical and circuit models of analog and digital devices depending on the frequency range, taking into account external factors, ability to use Internet information resources to obtain mathematical and design models of radio components from manufacturers based on an assessment of the characteristics of information transmission in radio networks

Program learning outcomes:

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 03 - Identify and apply in professional activities methods for testing information and telecommunications networks, telecommunications and radio engineering systems of intelligent technologies for compliance with the requirements of domestic and international regulatory documents.

PLO 04 - Explain the results obtained as a result of measurements in terms of their significance and relate them to the relevant theory.

PLO 05 - Skills in evaluating, interpreting, and synthesizing information and data.

PLO 06 - Adapt to changes in information and communication networks, telecommunications, and radio engineering systems.

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

PLO 08 - Describe the principles and procedures used in telecommunications systems, information and telecommunications networks.

PLO 09 - Analyze and evaluate the effectiveness of methods for designing information and telecommunications networks, telecommunications and radio engineering systems

PLO 10 - Communicate on professional issues, including oral and written communication in the state language and one of the common European languages (English, German, Italian, French, Spanish)

PLO 11 - Apply interpersonal skills to interact with others and engage them in teamwork

PLO 12 - Tolerantly perceive and apply ethical standards of behavior towards other people

PLO 13 - Apply fundamental and applied sciences to analyze and develop processes occurring in telecommunications and radio engineering systems

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

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

PLO 17 - Understanding and complying with domestic and international regulatory documents on the development, implementation, and technical operation of information and telecommunications networks, telecommunications, and radio engineering systems.

PLO 18 - Finding, evaluating, and using information from various sources necessary for solving professional tasks, including reproducing information through electronic search.

PLO 19 - Perform standard tests of information and communication networks, telecommunications and radio engineering systems for compliance with the requirements of domestic and international regulatory documents.

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 24 - Implement digital signal processing methods at the software and hardware levels

PLO 25 - Select and implement means and methods of information transmission in communication networks and apply network technologies

PLO 26 - Design and implement elements of intelligent technologies using software-configurable hardware
PLO 28 - Apply methods and means of influencing the parameters of the physical environment

PLO 29 - Select the configuration, structure, main components, and elements of radio-electronic equipment depending on its purpose

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

PLO 31 - Apply the basics of designing radio-electronic equipment for intelligent systems and the latest component base and materials when designing radio-electronic equipment for intelligent systems

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)*

Prerequisites: Diploma design is based on knowledge of all disciplines of the curriculum of the bachelor's degree program, which are studied by students majoring in 172 "Electronic Communications and Radio Engineering," educational program "Intelligent Technologies of Radio Electronics" during 1-8 semesters of study.

Postscript: Diploma design is the final stage of training and consists of completing a qualification project (work) to obtain a bachelor's degree for students majoring in 172 "Electronic Communications and Radio Engineering," educational program "Intelligent Technologies of Radio Electronics." This involves the development of radio-electronic devices for computerized radio engineering systems and the implementation of software for the corresponding systems, as well as the creation of documentation in the form of an explanatory note and graphic material for the diploma project.

3. *Contents of the academic discipline*

The main tasks of the thesis project are:

– systematization, consolidation, and expansion of theoretical knowledge gained in the process of studying the bachelor's educational program, and its practical application in solving specific engineering and scientific problems in a particular field of professional activity;

– development of independent work experience, mastery of research and experimentation methods, physical or mathematical modeling, use of modern information technologies in the development of radio engineering devices and systems, which are provided for in the certification work assignment;

– determination of the compliance of the level of training of a higher education applicant with the requirements of the educational program, his readiness and ability to work independently in the conditions of a market economy and modern production, progress of science and technology.

During the diploma project, the student must collect and analyze theoretical and practical materials related to the topic of the certification work, conduct research, measurements, tests in a given field, perform the necessary calculations and design work in accordance with the technical specifications, write an explanatory note, and prepare illustrative material in accordance with the topic of the qualification project (work). The diploma project (work) may also involve research, calculations, experimental work, or the development of algorithms for processing the information obtained, which are necessary for the functioning of the device or system.

Therefore, qualification projects (works) are expected to be carried out in one of two areas: design or research.

A design-oriented qualification project (diploma project DP) involves the design of a functionally

complete device or its structurally complete part. Design developments must be carried out at the technical project level. The topics of design-oriented qualification projects are as follows:

- development or modernization of existing telecommunications and radio engineering devices and systems;
- development and modernization of measuring devices (systems) used to study physical effects and processes occurring in radio engineering devices and systems;
- optimization of circuit solutions in the creation of special telecommunications, radio engineering, and computerized devices.

A research-oriented qualification project (diploma thesis) involves conducting theoretical and practical research in the field of radio engineering, radio electronics, analytical and statistical processing, formulating research results and recommendations for their application.

The approximate volume of qualification works for bachelor's degree candidates is 50 pages of explanatory notes to the thesis project (text part of the thesis without appendices) and mandatory graphic (illustrative) material. The text is usually printed on A4 sheets in Times New Roman font, size 14, with 1.5 line spacing.

A bachelor's thesis project (work) may be based in part on the results of course design.

4. *Teaching materials and resources*

1. Law of Ukraine. On Higher Education: as amended on 28.05.2023 / Verkhovna Rada of Ukraine — Access mode: https://zakon.rada.gov.ua/laws/show/1556-18#Text — Title from the screen
2. Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" — Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2021 — Access mode: https://kpi.ua/code — Title from the screen
3. Regulations on the organization of the educational process at Igor Sikorsky Kyiv Polytechnic Institute — Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2020. — Access mode: https://kpi.ua/regulations — Title from the screen
4. Regulations on the Examination Commission and Certification of Higher Education Applicants at Igor Sikorsky Kyiv Polytechnic Institute — Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2023. — Access mode: https://osvita.kpi.ua/node/35 — Title from the screen
5. Recommendations on the structure and content of qualification works of bachelor's and master's degree applicants — Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2022. — Access mode: https://osvita.kpi.ua/node/973 — Title from the screen
6. Regulations on the system for preventing academic plagiarism at the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" — Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2020. — Access mode: https://osvita.kpi.ua/sites/default/files/downloads/Pologen_pro_plagiat.pdf — Title from the screen
7. Procedure for establishing facts of academic integrity violations at Igor Sikorsky Kyiv Polytechnic Institute — Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2022. — Access mode: https://document.kpi.ua/files/2022_HY-165a1.pdf— Title from screen
8. DSTU 3008:2015. Reports in the field of science and technology. Structure and rules of formatting — Effective from June 22, 2015 — Kyiv: DP "UkrNDNC", 2015. — 26 p.
9. DSTU 8302:2015 "Information and documentation. Bibliographic references. General provisions and rules for compilation" — Effective from June 22, 2015 — Kyiv: DP "UkrNDNC", 2016. — 16 p.

Educational content

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

The organizational process of completing certification work consists of the following stages:

– preparatory, which begins with the student choosing a topic and receiving an individual assignment from the supervisor on issues to be addressed during the pre-diploma internship on the chosen topic (familiarization with the state of the problem, collection of factual materials, conducting necessary observations, experiments, research, etc.), includes mastering the pre-diploma internship program and ends with the preparation and defense of a report on its completion (credit);

– main stage, which begins immediately after the defense of the practice report and ends approximately one week before the defense of the thesis project, when the thesis project is submitted for preliminary defense. At this stage, the certification work must be completed and checked by the supervisor and consultants;

– final, which includes receiving feedback from the supervisor and a review. Completed certification works with feedback from the supervisor are submitted by students to the department no later than one week before the day of defense to the examination commission (EC). The head of the department, based on the submitted materials and, if necessary, the results of an interview with the student, makes a decision on admission to the defense and puts a visa on the title page of the student's certification work. The decision of the head of the department is formalized by the relevant minutes of the department meeting.

The master's thesis consists of a text part and a graphic part. The text part of the project should reveal the content of the certification work, contain an analysis of the current state of the problem, methods for solving the project tasks, justification of their optimality, methods and results of calculations, a description of the experiments conducted, an analysis of their results, and conclusions based on the material considered; contain the necessary illustrations, sketches, graphs, diagrams, tables, charts, drawings, etc. It should not contain well-known statements, unnecessary descriptions, complex formulas (if necessary, they can be included in the appendices to the explanatory note), etc. The graphic part contains at least four graphic materials (necessary diagrams, drawings, charts, etc.).

The final stage is preparation for the defense of the certification work at a meeting of the examination commission and the defense procedure itself.

In terms of structure, the student's report at the EC meeting can be divided into three parts, each of which represents an independent content block, but in general they are logically connected and characterize the content of the research.

In the first part of the report, it is necessary to present the topic of the master's thesis, characterize the relevance of the chosen topic, describe the problem, and formulate the goal and objectives of the project.

The second part, which is the largest in terms of volume, characterizes each section of the work in the sequence established by the logic of the research. Particular attention is paid to the methods used to obtain the factual material and the final results.

The report ends with a concluding section, which provides general conclusions.

6. *Independent work of the student*

Students are allocated 180 hours for independent work. It consists of the following stages:

No.	Title of the topic for independent study	Approximate number of hours
1	Review and analysis of existing solutions on the topic of the assignment of the certification work	15
2	Description of the subject environment	10
3	Definition of the subject and tasks of the diploma design project	5
4	Determination of input and output data	5
5	Determination of methods and means for solving thesis design problems design	10
6	Description of the system structure (theoretical calculations)	20
7	System or subsystem development	10
8	Detailed design of system elements (conducting experiments and mathematical modeling)	15
9	Creation of software and hardware for the system (creation of a prototype, if necessary)	20
10	Conducting modeling and experimental research of proposed approaches to solving problems that confirm the correctness of the chosen solutions	10
11	Creation of graphic materials for the certification work	10
12	Writing and formatting an explanatory note for the certification work	10
13	Preparing a report for the defense of the certification work	5

Policy and control

7. *Policy of the academic discipline (educational component)*

System of requirements that the teacher sets for the student:

- to choose a thesis project topic in a timely manner and receive preliminary assignments for the thesis (research paper) and recommendations from the supervisor regarding the selection and processing of materials during the pre-thesis internship;
- regularly, at least once a week, inform the supervisor about the status of the project in accordance with the schedule, provide the necessary materials for verification at his request;
- independently complete the thesis project;
- take into account modern achievements in science and technology when developing questions, use advanced methods of scientific and experimental research, make informed and optimal decisions using a systematic approach;
- be responsible for the correctness of decisions, justifications, calculations, the quality of text and graphic material, their compliance with the methodological recommendations of the graduating department regarding the completion of certification work, existing regulatory documents, and higher education standards;
- adhere to the work schedule, respond in a timely and adequate manner to comments and recommendations from the supervisor and consultants;
- submit the thesis project for review to the supervisor (and consultants, if any) within the established deadline and, after addressing their comments, return it to the supervisor for approval feedback (only after checking for plagiarism);
- submit the completed work to the responsible person of the department for plagiarism check. Based on the results of the plagiarism check, the supervisor writes a review in which, among other things, he/she makes a conclusion about the originality of the work (indicating the percentage of text matches and their explanation).

- obtain all necessary signatures on the title page of the project, as well as a resolution from the head of the graduating department on admission to the defense;
- submit the thesis project (or, after receiving admission, send it by electronic means (e-mail, Telegram, Viber) to the reviewer) for review. If necessary, provide the reviewer with the necessary explanations on the issues that were developed;
- familiarize yourself with the content of the supervisor's feedback and review and prepare (if necessary) reasoned responses to their comments when defending the project before the examination committee (EC). It is prohibited to make any changes or corrections to the certification work after receiving the supervisor's feedback and review;
- pass a preliminary defense at the department within the established deadlines (in Zoom); • submit a prepared and approved thesis project with a supervisor's review and a review by at least one week before its defense before the examination committee (the completed work with all signatures, scanned copies of the review and review is submitted to the committee for defense);
- prepare a presentation for the defense of the work, which will take place online. The approximate time for the report is 5-7 minutes. The defense takes place publicly using the Zoom platform;
- Inform the person in charge in a timely manner about your readiness for the defense (or notify the head of the graduating department and the chair of the EC (through the EC secretary) about your inability to attend the defense, stating the reasons for this and subsequently providing documents confirming the validity of the reasons. The EC, if possible, may postpone the date of the defense.

8. *Types of control and rating system for assessing learning outcomes*

Rating point system and assessment criteria

The applicant's level is assessed in accordance with the rating system of assessment (RSA), which includes both the assessment of the quality of the qualification work and the assessment of its defense.

The quality of the qualification work is determined by the quality of the explanatory note, text, and graphic (illustrative) material. This includes the modernity and justification of the decisions made, the correct application of analysis and calculation methods, the quality of the design, compliance with regulatory requirements, the quality of graphic material, and compliance with standards, etc. The quality of the explanatory note and graphic material is assessed by the reviewer.

The examination committee evaluates the defense of the qualification work according to the following criteria: quality of the report and presentation, degree of mastery of the material, degree of justification of the decisions made, ability to defend one's opinion. Grades are given by each member of the examination committee individually on a 100-point scale.

Quality of the thesis (maximum 60 points)

1. Practical focus of the thesis project (10 points in total)

10 points – The project was carried out at the request of an enterprise or institution. The technical specifications were approved by the customer.

9 points – The project was carried out within the framework of a commercial contract or state order (technical specifications for the topic are attached).

8 points – The project was carried out in the interests of the department's educational process. Didactic requirements for the work were approved by the head of the department. 7 points – The project is based on real source data. 6 points – The project is purely educational in nature.
0 points – The project has no practical focus.

2. ***Quality of technical (technological) and economic justification of key decisions (10 points in total)***

10 points – At least three options for solving the problem are considered. The optimal option is selected based on a reasonably chosen criterion.

8-9 points – At least two options for solving the problem are considered. The choice of the rational option is justified.

6-7 points – The solution is chosen based on a qualitative comparison of at least two options for solving the problem.

0 points – A non-alternative solution is chosen without sufficient justification

3. ***Modernity and originality of the decisions made. Justification of the use of analysis and calculation methods (10 points in total)***

10 points – Decisions are made based on an analysis of the latest domestic and foreign scientific, technical, and patent literature and contain original, promising ideas proposed by the student personally (according to the supervisor's review). The methods of analysis and calculation of the device (system, technology) under development are chosen reasonably and correspond to the current level.

8-9 points – Decisions made based on an analysis of domestic and foreign scientific, technical, and patent literature and correspond to the level of promising models. The methods of analysis and calculation correspond to the current level.

6-7 points – Key decisions were made without sufficient analysis of the current state of affairs and correspond to the level of modern serial models. The analysis and calculations carried out made it possible to justify the basic requirements for the components (elements) of the device (system, technology) being designed, taking into account the initial data for the thesis project.

0 points – Decisions correspond to outdated models. The methods of analysis and calculation do not correspond to the current level and are not justified.

4. ***Level of experimental verification of the decisions made (10 points in total)***

10 points – Experimental verification of the main decisions was carried out at the modern technical and methodological level (the quality of the software product was verified according to several criteria). An analysis of the accuracy of the results and their comparison with theoretical conclusions was performed.

8-9 points – The ability to qualitatively carry out experimental verification of key decisions has been demonstrated (the quality of the software product has been verified according to one of the possible criteria). The results have been analyzed and conclusions have been drawn.

6-7 points – Experimental verification of technical decisions is limited (the software product was tested for operability). The results were analyzed and conclusions were drawn.

0 points – No experimental verification was performed.

or

10 points – The modeling method has been chosen reasonably. The boundary and initial conditions have been correctly defined. An analysis of the adequacy of the developed model has been carried out, and the modeling results have been compared with theoretical conclusions.

8-9 points – The choice of modeling method is correct but not sufficiently justified. The developed model is adequate for the object; the main assumptions are correct but not sufficiently justified.

6-7 points – The modeling method is not justified. Some assumptions are incorrect or

unjustified. 0 points – No experimental verification was performed.

5. Quality of explanatory notes and graphic material (10 points in total)

10 points – The material is presented clearly, concisely, and competently. The design fully complies with the requirements of regulatory documents. The graphic material fully reveals the content of the project, is made using computer graphics, and complies with the requirements of regulatory documents.

8-9 points – The material is presented clearly and concisely, but there are stylistic errors. The layout deviates slightly from the requirements of regulatory documents. The graphic material fully reveals the content of the project, but the structure of the sheets is not optimal. High technical level of execution in compliance with the requirements of regulatory documents.

6-7 points – The material is presented unclearly, there are grammatical errors. The graphic material does not fully reveal the content of the project, there are minor deviations from the requirements of the standards.
The work is done at a satisfactory technical level.

0 points – Design with significant violations of regulatory documents. The graphic material does not reveal the content of the project, there are significant deviations from the requirements of the standards.

6. Level of use of information technology (10 points in total)

10 points – Design tasks were solved using several modern programs (CAD/CAM/CAE/MathCAD/MathLab/Access/FoxPro, etc.) or using CAD to optimize the design of the system (device, technology). The choice of programs is justified. The Internet was used to collect the necessary information.

8-9 points – At least one modern program or a program developed independently or with the help of CAD was used to solve the design tasks. The use of information technologies made it possible to significantly improve the level of design task solutions.

6-7 points – Information technologies are used to perform basic calculations and at the level of office technology use.

0 points – Information technology is not used to solve basic work issues.

Defense of the qualification work (maximum 40 points)

36-40 points – High quality of the report, complete mastery of the material, excellent justification of decisions made. The student is able to defend their opinion.

31-35 points – Above-average quality of response, minor gaps in mastery of the material are acceptable. The student justifies decisions well and is able to

defend their opinion.

24-30 points – Average quality of the student's response. Insufficient mastery of the material, average justification of decisions made, insufficient ability to defend their opinion.

0 points – Low level of answer quality. The student has poor knowledge of the material,

does not justify their decisions, and is unable to defend their opinion.

The final score cannot exceed 100 points.

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

Number of points	*Rating*
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)*

After successful defense of the diploma:

The student must submit the following to the secretary of the EC in a paper folder

with ties: • An explanatory note bound in a hardcover with original signatures

Printed and folded drawings/posters. Drawings must be signed • A printed

and bound presentation (can be black and white)

The person responsible for placing qualification works in the Electronic Archive of Scientific and Educational Materials of Igor Sikorsky KPI publishes an electronic version of the qualification work, if it does not contain any documented state or commercial secrets.

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

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Work program for the academic discipline (syllabus):
Compiled by Shulga A. 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)