



DIPLOMA DESIGN

Work program (Syllabus)

Details of the educational component

Level of higher education	<i>First (undergraduate)</i>
Discipline	<i>14 "Electrical engineering"</i>
Specialty	<i>141 "Electric power engineering, electrical engineering and electromechanics"</i>
Educational program	<i>"Electromechanical automation systems, electric drive and electric mobility"</i>
Discipline status	<i>Mandatory (normative) cycle of professional training</i>
Form of education	<i>Full-time (daytime) / remote</i>
Year of training, semester	<i>4th year, spring semester</i>
Scope of the discipline	<i>180 hours / 6 ECTS credits</i>
Semester control/ control measures	<i>Defense of the diploma project</i>
Class schedule	
Language of teaching	<i>Ukrainian</i>
Information about the head of the course / teachers	
Placement of the course	<i>https://do.ipk.kpi.ua/course/view.php?id=5744 https://epa.kpi.ua/bachelor-student-learning/grad-work/</i>

1. Description of the educational component

1.1. Description of the educational component, its purpose, tasks and learning outcomes

Diploma planning is a form of attestation of applicants for higher education, which is conducted to assess the level of educational achievements of applicants in accordance with the knowledge, skills and other competencies they have acquired in accordance with the educational program.

The syllabus of the educational component "Diploma design" is compiled in accordance with the educational program "Electromechanical systems of automation, electric drive and electromobility" of bachelor's training in specialty 141 - Electric power engineering, electrical engineering and electromechanics. Diploma design is the final stage of training under the program of the first level of higher education "Bachelor" degree and takes place after the completion of the full theoretical course provided by the curricula and pre-diploma practice. Based on the results of the

defense of the diploma project, the examination board makes a decision on awarding the student with the appropriate qualification and educational degree.

Interdisciplinary connections. Diploma design is conducted as a single comprehensive attestation event based on the disciplines studied as part of the bachelor's degree curriculum.

The purpose of diploma design there is a check of the availability of the first (bachelor) level of higher education applicants with the competencies necessary for professional work in the field of electric power, electrical engineering and electromechanics; generalization and consolidation of theoretical knowledge and practical skills acquired at the university; assimilation of the methodology of creative solution of modern scientific and applied problems on the basis of acquired knowledge and professional skills in accordance with the requirements of higher education standards; mastering modern methods and forms of work organization, work tools in the field of their future specialty.

Provided that the curriculum is implemented in accordance with [the educational program](#) "Electromechanical systems of automation, electric drive and electromobility" of bachelor's training in specialty 141 - Electric power, electrical engineering and electromechanics, the applicant must master the following **software competencies** : (Z K02) Ability to apply knowledge in practical situations; (ZK03) Ability to communicate in the state language both orally and in writing; (ZK05) Ability to search, process and analyze information from various sources; (ZK06) Ability to identify, pose and solve problems; (ZK08) Ability to work autonomously; (FC10) Awareness of the need to constantly expand one's own knowledge about new technologies in electric power, electrical engineering and electromechanics; (FC13) Ability to use modeling software packages for analysis, synthesis and research of electromechanical automation systems and electric drives; (FC15) Ability to perform calculations of the mechanical part of the electric drive, mechanical transients, calculate the parameters of DC and AC motors, perform their modeling and analysis; (ΦK16) The ability to solve complex problems related to the control of automated electric drives of various technological applications with direct and alternating current electric drives.

Upon completion of the training course in accordance with the requirements of the educational program, the applicant must acquire the following **learning outcomes** : (PRN06) Apply application software, microcontrollers and microprocessor technology to solve practical problems in professional activities; (PRN08) Choose and apply suitable methods for the analysis and synthesis of electromechanical and electric power systems with specified indicators; (PRN10) Find the necessary information in scientific and technical literature, databases and other sources of information, evaluate its relevance and reliability; (PRN11) Communicate freely about professional problems in the national language orally and in writing, discuss the results of professional activity with specialists and non-specialists, argue one's position on debatable issues; (PRN18) To be able to learn independently, acquire new knowledge and improve the skills of working with modern equipment, measuring equipment and application software.

1.2. Pre-requisites and post-requisites of the educational component

Prerequisites for diploma design (place in the structural and logical scheme of study according to the relevant educational program): have knowledge of the disciplines of the bachelor's degree curriculum.

Post-requisites: design, implementation and adjustment of automation systems of electric drives and technological processes, creation of appropriate technical documentation in the form of an explanatory note and graphic material of the diploma project.

2. Organization of diploma design

2.1. The main tasks of diploma design

The bachelor's diploma project must be based on the knowledge and skills acquired during the study of the disciplines during the entire period of study and may involve the performance of experimental, project, calculation, experimental works, as well as be partially based on the results of course design.

Diploma design tasks include:

- *systematization, consolidation and expansion of theoretical knowledge obtained in the process of studying under the bachelor's educational program and their practical use in solving specific engineering, scientific, economic, social and industrial issues in a certain field of professional activity;*
- *gaining experience of independent work, mastering the methodology of research and experimentation, physical or mathematical modeling, use of modern information technologies in the process of solving tasks, which are provided for in the task of attestation work;*
- *determination of compliance of the level of training of the higher education applicant with the requirements of the educational program, his readiness and ability to work independently in the conditions of the market economy, modern production, progress of science, technology and culture.*

2.2. Normative basis for the organization of diploma design

The organization and conduct of diploma design is regulated by the following documents:

- *Regulations on the examination commission and attestation of applicants for higher education at KPI named after Igor Sikorskyi (<https://kpi.ua/diplom>);*
- *Regulations on graduation certification of students of KPI named after Igor Sikorskyi [Electronic resource] / Compiler: V. P. Golovenkin, V. Yu. Ugolnikov. – Kyiv: KPI named after Igor Sikorskyi, 2018. – 98 p. (<https://osvita.kpi.ua/node/35>);*
- *Regulation on the organization of diploma design and state certification of students of NTUU "KPI" / Reg. V. Yu. Ugolnikov. In general ed. Yu. I. Yakymenko - K.: VPK "Polytechnic", 2006. - 84 p.;*
- *Regulations on the system of evaluation of learning results at KPI named after Igor Sikorskyi (<https://kpi.ua/scale>);*
- *Educational program "Electromechanical automation systems, electric drive and electric mobility" (https://osvita.kpi.ua/141_OPPB_EMSAEPPEM);*
- *syllabus of diploma design;*
- *examination information on the results of defense of diploma projects.*

2.3. Stages of diploma design

Organizationally, the process of certification works consists of the following stages:

- *preparatory, which begins with the student choosing a topic and receiving an individual assignment from the supervisor regarding issues that must be resolved during pre-diploma practice on the chosen topic (familiarization with the state of the problem, collection of factual materials, conducting the necessary observations, experiments, research, etc.), includes mastering programs of pre-diploma practice and ends with the preparation and defense of a report on its completion;*
- *the main one, which begins immediately after the defense of the practice report and ends approximately two weeks before the defense of the diploma project, when the diploma project is submitted for preliminary defense. At this stage, the attestation work must be fully completed, checked by the manager and consultants;*
- *the final one, which includes receiving feedback from the manager, reviews and checking for plagiarism. Completed attestation works with the supervisor's feedback are submitted by students*

to the graduation department no later than one week before the day of defense to the examination board (EC). The head of the department, based on the results of the interview with the student and review of the submitted materials, makes a decision on admission to the defense and puts a visa on the title page of the student's attestation work. The decision of the head of the department is formalized in the relevant protocol of the department meeting.

The diploma project consists of a textual and graphic part. The textual part of the project should in a concise and clear form reveal the creative idea of the work, contain an analysis of the current state of the problem, methods of solving project tasks, justification of their optimality, methods and results of calculations, a description of the conducted experiments, analysis of their results and conclusions from them; contain the necessary illustrations, sketches, graphs, charts, tables, diagrams, drawings, etc. It should be free of well-known provisions, redundant descriptions, derivation of complex formulas, etc. The graphic part of the project in a condensed form illustrates the main design results.

The content of the explanatory note of a typical bachelor's diploma project for the educational program "Electromechanical automation systems, electric drive and electric mobility" includes:

1. Analytical review. Description of the technological process (installations).
 - 1.1. Analytical review (about).
 - 1.2. Description of the technological process (installations).
 - 1.3. Formulation of requirements for the electric drive and control system of the technological facility .
2. Determining the required engine power.
 - 2.1. Energy calculation of technological object parameters.
 - 2.2. Justification of the choice of engine power (o).
3. Selection of electric motor and power electrical equipment.
4. Mathematical model of an electromechanical object . Calculation of static and dynamic parameters of the electric drive.
5. Synthesis (design) of the control system.
 - 5.1. Justification of the principle of electric drive control (o).
 - 5.2. Structural and parametric synthesis of the control system.
 - 5.3. Calculation of parameters of regulators and feedback.
6. Study of static and dynamic modes of an electromechanical system (study of dynamics by modeling, research on an experimental setup). Analysis of results.
7. Development and description of the control scheme (o).

Content of the graphic part of the diploma project:

1. Drawing of the general type of installation.
2. The structural diagram of the control system and the results of the study of dynamic modes.
3. The basic electrical scheme of the power part of the electric drive.
4. Electrical schematic diagram of the control device (o).

Note :

1. (o) – optional;
2. For non-standard diploma projects of the research direction, as well as projects aimed at the development of the department's laboratory base, the content of the explanatory note and graphic part is approved by the department.

Estimated volume of the diploma project: explanatory note - 60-70 pages; mandatory graphic (illustrative) material - at least 3 sheets of drawings (posters) in A1 format in electronic form; presentation for the defense report - up to 10 slides.

2.4. Preparation and defense of diploma projects

The final stage of the diploma project is preparation for the presentation and defense of the work at the meeting of the examination commission.

Structurally, the student's report at the meeting of the EC 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 conducted research.

In the first part of the report, it is necessary to present the topic of the project, characterize its relevance, give a description of the problem, as well as formulate the goal and tasks of the project.

The second, the largest part, in the sequence established by the logic of the conducted research, characterizes each section of the work. At the same time, special attention is paid to the justification of the methods used to obtain the actual material and the final results.

The report ends with the final part, where specific design results and general conclusions are presented.

3. Policy and control of the educational component

During the diploma project, the student is obliged to:

- timely choose the topic of the diploma project and receive a preliminary assignment for the DP and recommendations from the supervisor regarding the selection and processing of materials during the pre-diploma practice;*
- regularly, at least once a week, to inform the manager about the status of project implementation in accordance with the calendar plan, to provide the necessary materials for inspection at his request;*
- independently carry out an individual diploma project or an individual part of a complex project;*
- when developing questions, take into account modern achievements of science and technology, use advanced methods of scientific and experimental research, make reasonable and optimal decisions using a systematic approach;*
- to be responsible for the correctness of the adopted decisions, justifications, calculations, the quality of design of text and graphic material, their compliance with the methodological recommendations of the graduation department regarding the performance of attestation works, existing regulatory documents and standards of higher education;*
- adhere to the work schedule, the established rules of conduct in the laboratories and classrooms, respond in a timely and adequate manner to the remarks and recommendations of the head of the SE and consultants;*
- submit the diploma project for review to the manager and consultants within the set deadline and, after eliminating their comments, return it to the manager for his feedback;*
- get all the necessary signatures on the title page of the project, as well as the resolution of the head of the graduation department on admission to the defense;*
- personally submit the diploma project, accepted for defense, to the reviewer; at his request, provide the necessary explanations on the issues that were being developed;*
- familiarize yourself with the content of the manager's feedback and review and the results of the plagiarism check and prepare (if necessary) reasoned answers to their comments when defending the project in the examination committee (EC). It is forbidden to make any changes or corrections to the certification work after receiving the manager's feedback and review;*
- adhere to the rules of integrity when completing the diploma project;*
- submit to the department a diploma project prepared and accepted for defense with the supervisor's feedback and a review at least one week before its defense in the examination board;*

- to arrive on time for the defense of the diploma project or to warn the head of the graduation department and the head of the EC (through the EC secretary) about the impossibility of attending the defense, indicating the reasons for this and the subsequent provision of documents certifying the validity of the reasons. In the absence of such documents, the EC may decide on non-certification of the student as one who did not appear for the defense of the diploma project without valid reasons, with further expulsion from the university. If the student did not have the opportunity to warn in advance about the impossibility of his presence at the defense, but during the period of work of the EC provided the necessary supporting documents, the EC can postpone the date of the defense.

4. Evaluation of the results of diploma design

According to the Regulation on the system of evaluation of learning results in KPI named after Igor Sikorskyi (<https://osvita.kpi.ua/node/37>) certification of applicants is carried out in the form of defense of the final certification work.

RSO for attestation work is developed by the graduation department and delivered to applicants together with the pre-diploma practice program.

4.1. A rating system for evaluating learning outcomes

The rating assessment for diploma design has two components. The first component characterizes the quality of the student's work during the diploma project, preparation of the explanatory note and graphic materials of the diploma project for defense and can be evaluated by the supervisor of the diploma project in the range of up to 20 points. The second component is determined by the examination committee during the meeting and takes into account the quality of the diploma project itself and its defense by the student. The size of the maximum scale for the second component is 80 points.

The components of the rating assessment for the examination committee are determined according to the following criteria:

1. Practical implementation of project materials :
 - "excellent", the project was executed at the request of the enterprise, institution; a scientific article was published based on the materials of the diploma project, a report was made at the conference; the layout of the device is developed; original software – 9-10 points;
 - "good", the project was carried out in the interests of the educational process of the department - 7-8 points;
 - "satisfactory", there is no external approval of the project - 6-7 points;
 - "unsatisfactory", project materials were not implemented - 0-5 points;
2. Justification of the relevance of the project goal, the depth of the analysis of the state of the problem solution:
 - "excellent", the analysis of the state of the problem was carried out according to the latest domestic and foreign sources - 5-6 points;
 - "good", the analysis of the state of the problem was carried out mainly based on domestic sources without using periodical scientific and technical foreign publications - 3-4 points;
 - "satisfactory", the analysis of the state was carried out mainly according to educational literature and outdated sources (more than 5 years) - 2 points;
 - "unsatisfactory", no analysis of the state of the problem - 0-1 point;
3. The depth of development of the theoretical provisions of the project:
 - "excellent", the choice of theoretical and/or experimental research methods was made on the basis of systemic analysis approaches - 5-6 points;

- "good", the research methods used are not sufficiently substantiated, the depth of theoretical research is insufficient - 3-4 points;
 - "satisfactory", mathematical models and calculations were carried out without justification - 2 points;
 - "unsatisfactory", research methods were not selected - 0-1 point;
4. The level of performance of a natural experiment or simulation:
- "excellent", self-developed layout, program was used, research was carried out at a modern technical and methodical level - 6-7 points;
 - "good", the experiments were carried out on standard equipment and software; the choice of research method, modeling method was made correctly, but without sufficient justification - 5-6 points;
 - "satisfactory", experiments were not conducted - 3-4 points;
 - "unsatisfactory", the model was not developed - 0-2 points;
5. The level of use of information technologies:
- "excellent", several modern information technologies are used - 5 points;
 - "good", only one modern special software was used - 4 points;
 - "satisfactory", outdated software tools were used - 3 points;
 - "unsatisfactory", software tools were not used - 0-2 points;
6. The quality of the explanatory note of the diploma project:
- "excellent", the requirements of the standards are fully met, the material is presented logically, consistently, clearly, in accordance with the requirements - 8-9 points;
 - "good", the requirements of the standards are not fully met, there are minor deviations from the requirements - 6-7 points;
 - "satisfactory", unclear presentation of the material, there are grammatical errors; registration with violations of the requirements of the relevant standards – 4-5 points;
 - "unsatisfactory", the design does not meet the requirements - 0-3 points;
7. The quality of preparation of graphic and illustrative material:
- "excellent", illustrative material fully and logically reveals the essence of the work; the requirements of the standards are fully met - 6-7 points;
 - "good", illustrative material does not fully reveal the essence of the work; the requirements of the standards are not fully met - 4-5 points;
 - "satisfactory", illustrative material is presented in insufficient volume; the requirements of the standards are not fully met - 2-3 points;
 - "unsatisfactory", illustrative material of low quality or absent - 0-1 points.
8. The quality of the defense report and answers to the questions of the examination committee:
- "excellent", the student clearly and fully disclosed the goal of the project, the ways to achieve it, deeply argues the decisions made. The answers to the questions demonstrate the student's ability to professionally defend his own point of view, as well as the fact that he possesses professional knowledge at the modern level - 25-30 points;
 - "good", the student clearly and fully disclosed the goal of the project, the ways to achieve it, deeply argues the decisions made, but insignificant errors and inaccuracies are assumed. The student knows how to professionally defend his own point of view. The answers to the questions are correct in essence, but not always sufficiently complete and reasoned - 19-24 points;
 - "satisfactory", the report on the completed project is essentially true, but constructed illogically, vaguely, there are many inaccuracies. The answers to the questions are incomplete, significant inaccuracies are assumed in the reasoning of the decisions made - 13-18 points;

- "unsatisfactory", the report does not meet the requirements, the student is unable to answer the question - 0-12 points.

The sum of the points scored for the first and second components is transferred to the final grade according to table 1.

Table 1 — Conversion of rating points to grades on the university scale

Total number of points	Rating
95-100	Perfectly
85-94	Very good
75-84	Good
65-74	Satisfactorily
60-64	Enough
Less than 60	Unsatisfactorily
Admission conditions not met	Not allowed

5. Normative, educational and methodical materials and resources

Regulatory documents

1. Law of Ukraine on higher education. Law dated July 1, 2014 No. 1556-VII [Electronic resource]. (<http://zakon1.rada.gov.ua/laws/show/1556-18>)
2. Clarification of the Ministry of Education and Culture regarding some issues of practical implementation of the provisions of the new Law of Ukraine "On Higher Education": [Electronic resource]. (http://www.kmu.gov.ua/control/publish/article7art_icN247526620)
3. Monitoring the integration of the Ukrainian system of higher education into the European area of higher education and scientific research: monitoring, research : analyst . report / International . blessing International Fund . research fund education, politics"; in general ed. T.V. Finikova, O.I. Sharova - K.: Takson, 2014. - 144 p.
4. Strategy for reforming higher education in Ukraine until 2020 (draft). – [Electronic resource]. (http://www.mon.gov.ua/img/zstored/files/HE%20Reforms%20Strategy%2011_11_2014.pdf)
- 5 . Regulations on the organization of the educational process at KPI named after Igor Sikorsky. – 2020. [Electronic resource]. (<http://osvita.kpi.ua/node/39>)
6. Provisions on the examination commission and certification of higher education applicants at KPI named after Igor Sikorskyi (<https://kpi.ua/diplom>)
7. Provisions on the system of evaluation of learning results at KPI named after Igor Sikorsky (<https://kpi.ua/scale>)
8. Educational program " Electromechanical systems automation , electric drive and electric mobility " (https://osvita.kpi.ua/141_OPPB_EMSAEPEN)

Basic information resources

1. Graduation qualification papers of bachelors and masters: execution, registration and defense [Electronic resource]: study guide for students . specialty 141 "Electric power engineering,

electrical engineering and electromechanics" under the educational program "Electromechanical systems of automation, electric drive and electric mobility" / KPI named after Igor Sikorsky; compiled by: S.M. Peresada , V.I. Teryaev . - Kyiv: KPI named after Igor Sikorsky , 2019. – 48 p. (<https://epa.kpi.ua/study/graduation-work/>)

2. Course " Diploma design » (<https://do.ipk.kpi.ua/course/view.php?id=5744>)

Additional information resources

1. Organization of practice and graduation . (<https://osvita.kpi.ua/node/17>)

2. Information and documentation. Reports in the field of science and technology. Structure and design rules. DSTU 3008:2015

(https://science.kname.edu.ua/images/dok/derzhstandart_3008_2015.pdf)

3. Rules for implementation of DST schemes 2.702-75*. ESCD

(<http://budinfo.org.ua/doc/1811327/DST-2-702-75-YeSKD-Pravila-vikonannia-skhem>)

4. Electric drives. Terms and definitions. DSTU 2313-93

(http://online.budstandart.com/ua/catalog/doc-page.html?id_doc=60224)

5. Bibliographic reference. General provisions and rules of drafting. DSTU 8302:2015, Kyiv, 2016. - 17 p. (<https://cutt.ly/AJ0h5vJ>)

6. Abbreviations of words and phrases in Ukrainian. General requirements and rules. DSTU 3582:2013. Kyiv, 2014. - 14 p.

7. Forms, samples of accompanying documentation, normative materials for the completion of final attestation works: website of the AEMS-EP department.

(<https://epa.kpi.ua/bachelor-student-learning/grad-work/>)

Working program (syllabus) in diploma design:

V.I. Teryaev , Associate Professor of the Department of Automation of Electromechanical Systems and Electric Drives of the FEA.

Approved by the Department of Automation of Electromechanical Systems and Electric Drives of the FEA (Protocol No. 15 dated 06.13.2024)

Agreed by the Methodical Commission of the faculty (protocol No. 10 dated 06/20/2024)