



# EXECUTION OF THE MASTER'S DISSERTATION

## Work program (Syllabus)

### Props

<b>Level of higher education</b>	<i>Second (master's)</i>
<b>Branch of knowledge</b>	<i>14 Electrical engineering</i>
<b>Specialty</b>	<i>141 Power engineering, electrical engineering and electromechanics</i>
<b>Educational program</b>	<i>Engineering of intelligent electrotechnical and mechatronic complexes</i>
<b>Discipline status</b>	<i>Mandatory</i>
<b>Form of education</b>	<i>full-time (full-time), part-time</i>
<b>Year of training, semester</b>	<i>2nd year, autumn semester</i>
<b>Scope of the discipline</b>	<i>12 credits / 360 hours</i>
<b>Semester control/ control measures</b>	<i>protection of qualification work</i>
<b>Lessons schedule</b>	<i><a href="https://schedule.kpi.ua">https://schedule.kpi.ua</a></i>
<b>Language of teaching</b>	<i>Ukrainian/ English</i>
<b>Information about the course leader / teachers</b>	<i>Coordinator - doctor of technical sciences, prof. Stefan Volodymyrovych Zaichenko, Supervisors of master's theses are approved in accordance with the established procedure</i>
<b>Placement of the course</b>	

### Educational component program

#### 1. Description of the educational discipline, its purpose, subject of study and learning outcomes

A master's thesis is a qualifying work, which should involve solving a complex problem of a research and/or innovative nature in the field of electrical engineering, and its topic should be relevant. The work should reveal the master's student's ability to formulate, plan, conduct and defend the results of independent research in the field of electrotechnical and mechatronic complexes using modern achievements, methods, approaches and tools.

During the course of the credit module, the student prepares an attestation work - a master's thesis (hereinafter "dissertation"), which is the final stage of education at the master's level. Based on the results of the preparation and defense of the dissertation, the examination committee (hereinafter EC) issues a decision on awarding the student with the appropriate qualification and educational degree. Subject of the academic discipline: execution of a master's thesis. Interdisciplinary connections. Completion of the master's thesis is based on all disciplines studied within the curriculum of the master's degree.

***the purpose***work is the formation and consolidation of the following competencies in students:

K01 Ability to search, process and analyze information from various sources.

K02 Ability to use information and communication technologies.

K03 Ability to apply knowledge in practical situations.

K07 Ability to identify and assess risks.

K10 Ability to communicate with representatives of other professional groups of different levels.

K11 The ability to apply existing and develop new methods, techniques, technologies and procedures for solving engineering tasks of electric power, electrical engineering and electromechanics.

K12 The ability to develop and implement measures to increase reliability, efficiency and safety in the design and operation of equipment and objects of the power industry, electrical engineering and electromechanics.

K13 The ability to carry out the analysis of technical and economic indicators and the examination of design solutions in the field of power engineering, electrical engineering and electromechanics.

K14 Ability to demonstrate knowledge and understanding of mathematical principles and methods required for use in electrical power, electrical engineering, and electromechanics.

K15 Ability to understand and take into account social, ecological, ethical, economic and commercial considerations affecting the implementation of technical solutions in electric power, electrical engineering and electromechanics.

K16 Ability to manage projects and evaluate their results.

K17 The ability to develop plans and projects to ensure the achievement of a specific goal, taking into account all aspects of the problem being solved, including production, operation, maintenance and disposal of equipment of electric power, electrotechnical and electromechanical complexes.

K18 Ability to demonstrate awareness and ability to use normative legal acts, norms, rules and standards in electric power, electrical engineering and electromechanics.

K19 Ability to use software for computer modeling, automated design, automated production and automated development or construction of elements of electric power, electrotechnical and electromechanical systems.

K20 Ability to demonstrate awareness of intellectual property and contract issues in electricity, electrical engineering and electromechanics.

K21 The ability to formulate technical requirements for products and technologies under development, to determine the technical conditions of operation and maintenance of new equipment, to draw up technical tasks for research and development, to highlight the key technological parameters of developments and to determine their target or normative values in the field of engineering.

K22 Ability to develop means, methods and methods of science and technology aimed at automating existing and creating new automated and automatic technologies and productions.

K23 Ability to optimize technological processes and build structural diagrams of intelligent automated control systems.

***Program learning outcomes***the formation and improvement of which is aimed at the educational component:

PR01. Reproduce processes in electric power, electrotechnical and electromechanical systems during their computer simulation.

PR02. Outline a plan of measures to increase the reliability, safety of operation and prolong the resource of electric power, electrotechnical and electromechanical equipment and relevant complexes and systems.

PR03. Analyze processes in electric power, electrotechnical and electromechanical equipment and corresponding complexes and systems.

PR05. To have the methods of mathematical and physical modeling of objects and processes in electric power, electrotechnical and electromechanical systems.

PR06. Search for sources of resource support for additional training, scientific and innovative activities.

PR07. Plan and carry out scientific research and innovative projects in the field of electric power, electrical engineering and electromechanics.

PR08. Take into account the legal and economic aspects of scientific research and innovative activities.

PR09. To adhere to the principles and directions of the energy security development strategy of Ukraine

PR11. Communicate freely orally and in writing in national and foreign languages on modern scientific and technical problems of electric power, electrical engineering and electromechanics.

PR12. Demonstrate understanding of regulations, norms, rules and standards in the field of electricity, electrical engineering and electromechanics.

PR13. Identify the main factors and technical problems that may hinder the implementation of modern methods of controlling electric power, electrotechnical and electromechanical systems.

PR15. Perform physical and mathematical modeling, static and dynamic analyzes of structures, mechanisms, materials and processes at the design stage, investigate the reliability of systems, using modern computer tools.

PR16. Choose the elemental base of electromechanical and mechatronic systems, complete electric and hydraulic drives, means of control, protection, automation of power supply systems of machines and installations, production sites and enterprises

PR17. To create intelligent and adaptive systems of automated management and control of the technical condition of electromechanical equipment based on the use of programmable logic controllers.

PR18. Calculate forces, stress-strain state, speeds, moments, power, static and dynamic properties of electromechanical equipment, perform power and hydraulic calculations of elements of hydraulic drives, electric drives, linear and non-linear elements, electric and magnetic circuits.

## **2. Pre-requisites and post-requisites (place in the structural and logical scheme of training according to the relevant educational program)**

The master's thesis is the final stage of preparation for the educational program.

In order to perform the work, the student must have knowledge of all mandatory academic disciplines provided for in the educational program and undergo practice.

Prerequisites: have knowledge of the disciplines of the master's degree curriculum.

Post-requisites: research, design and implementation of the object using modern modeling methods, development of appropriate documentation in the form of an explanatory note and graphic material for the dissertation.

## **3. Content of the educational component**

The master's thesis is a qualifying work, its content should reveal the author's presence of competencies, which are specified in the educational program, and be related to the solution of specific scientific or applied problems.

The main tasks of the master's thesis:

- systematization, consolidation and expansion of theoretical knowledge obtained in the process of studying under the master's educational program, and their practical use in solving specific engineering, scientific, economic, social and industrial issues in a certain field of professional activity;
- development of experience of independent work, mastering the methodology of research and experimentation, physical or mathematical modeling, use of modern technologies of artificial intelligence in the process of solving tasks, which are provided for the task of completing the dissertation;
- determination of compliance of the level of training of the applicant of higher education 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.

The preparation of a master's thesis involves:

- formulation of a scientific-technical or applied problem, definition of the object, subject and goal of the research, analysis of the state of the solution to the problem based on the materials of domestic and foreign publications, justification of the research goals;
- analysis of possible research methods and options for solving the task, justified choice

- (development) of research method (methodology) or technical solution;
- scientific analysis and generalization of factual material used in the process of research or performing calculations regarding the chosen technical solution;
- presentation of the obtained results and assessment of their theoretical, applied, or scientific-methodological significance;
- checking the possibilities of practical implementation of the obtained results;
- approbation of the obtained results and conclusions in the form of reports at conferences, preparation of startup projects, etc.;
- publications in scientific journals and anthologies (based on the results of the master's thesis).

The dissertation must be based on the knowledge and skills acquired during the study of the disciplines during the entire period of study at the higher education institution and may be partially based on the results of the course design. The dissertation may include research, design, calculation, and experimental works.

Dissertation topics are determined in accordance with the following directions:

- The system of increasing the energy efficiency of electrical engineering facilities;
- Geomechatronic systems of resource-saving technologies;
- Adaptive shock wave systems;
- Chemical reliability and energy-saving technologies in energy and transport.

The topic of the dissertation is generally not determined by the directions listed above and can be proposed by the student within the directions of artificial intelligence.

Dissertations can be complex. They are performed by two or even more students.

#### **4. Educational materials and resources**

##### **Basic literature**

1. Master's dissertation: requirements for implementation, composition, typography and defense [Electronic resource]: Tutorial for students studying for Specialty 141 «Electricity, electrical engineering and electromechanics», educational program «Electric Machines and Apparatus» / Igor Sikorsky KPI; compilers: Anna Shymanska, Sergiy Tsivinskiy. – Electronic text data (1 file: 2.376 kB). – Kyiv: Igor Sikorsky KPI, 2019. – 54 p. (<https://ela.kpi.ua/bitstream/123456789/38847/1/Master%27s%20dissertation.doc>).
2. Babbie, Earl. (2011). "The basics of social research (5th edition). Belmont, CA: Wadsworth." (ISBN 9780495812241)
3. Booth, Wayne C. Et al. (2008). "The craft of research (3rd edition). Chicago: University of Chicago Press. (ISBN 9780226065663)

##### **Supporting materials and resources**

4. Bui, Yvonne N. (2009). "How to write a master's thesis." Thousand Oaks, CA: Sage Publications. (ISBN 9781412957106)
5. Graff, Gerald, & Birkenstein, Cathy. (2010). They say / I say (2nd edition). New York: W.W. Norton & Co. (ISBN 9780393933611)

#### **5. Methods of mastering an educational discipline (educational component)**

In general, the process of completing a master's thesis consists of the following stages:

- preparatory stage: choosing a research direction, choosing a scientific supervisor, detailing the topic of the work, selection and analysis of the literature, drawing up a calendar plan for the implementation of the work;

- the main stage: execution and design of the work in the form of a manuscript. At this stage, the master's student conducts research, interacts with the academic supervisor, consultants;
- final stage: receiving feedback from the scientific supervisor, reviews of the master's thesis, receiving a report on the textual originality of the work (plagiarism check),
- preliminary defense at the department. Admission to the defense of the qualification work in the examination committee is carried out by the head of the graduation department based on the results of the preliminary defense.

## 6. Independent work of student

<b>No</b>	<b>Tempo</b>	<b>SRS hours</b>
1	Primary formulation of the goal and objectives of the master's thesis	10
2	Analytical overview of the problem: an overview of the current state of the industry, Formulation of the problem, justification relevance of the chosen topic, general setting of tasks	60
3	Study, description of the research object; determination of methods and means problem solving	40
4	Solving the tasks: implementation of theoretical and practical aspects of the master's thesis	140
5	Designing work results	60
6	Passing the procedure of admission to protection	40
7	Preparation for the defense of a master's thesis	10
<b>Together</b>		<b>360</b>

The topics and the number of hours are approximate, depend on the chosen topic and can be changed in agreement with the academic supervisor, provided that the purpose, content and expected results of qualification work.

## **7. Policy and control**

### **The policy of the educational component**

#### **The student has the right to:**

- choose the topic of the qualification work from among those offered by the graduation department or propose your own topic with the necessary justification of the feasibility of its development and the possibility of implementation;
- use the department's laboratory and information base to conduct scientific research on the topic of the work;
- to receive consultations from the manager, consultants, scientific, scientific and pedagogical staff of the department;
- independently choose options for solving tasks for qualification work;
- apply (orally or in writing) to the chairman of the examination commission (EC), the management of the faculty, the university and the Ministry of Education and Culture with complaints or appeals regarding the violation of his rights;
- familiarize yourself with the content of the scientific supervisor's feedback and review and prepare (if necessary) reasoned answers to their remarks when defending the work in the EC.

#### **The student is obliged to:**

- timely choose the topic of the qualification work and receive a preliminary task for the qualification work and recommendations from the scientific supervisor for the selection and processing of materials during the internship;
- after drawing up and defending the practice report, obtain from the academic supervisor the final task for the qualification work according to the established form, approved by the head of the graduation department, and find out the content, features and requirements for the fulfillment of its individual questions;
- adhere to the calendar schedule of work performance and regularly, at least once every two weeks, inform the scientific supervisor about the status of work performance, provide the necessary materials for inspection at his request;
- perform qualification work independently;
- when developing questions, take into account modern achievements of science and technology, use advanced methods of scientific research, make reasonable and optimal decisions using a systematic approach;
- use modern computer technologies when performing work;
- to be responsible for the correctness of decisions, justifications, calculations, quality of design of textual and graphic material, their compliance with the methodological recommendations of the graduation department, existing regulatory documents and standards of higher education.
- to observe the established rules of behavior in laboratories and classrooms, to respond in a timely and adequate manner to the remarks and recommendations of the scientific supervisor and consultants of the qualification work;
- submit the qualification paper for review to the scientific supervisor within the set deadline and, after eliminating their remarks, return it to the scientific supervisor for his feedback;
- get all the necessary signatures on the title page of the work, as well as the resolution of the head of the graduation department on admission to the defense;
- personally submit the qualification work accepted for defense to the reviewer; at his request, provide the necessary explanations on the issues that were being developed;

- by the decision of the faculty, graduation department or on one's own initiative and with the consent of the scientific supervisor of the work, pass a preliminary defense at the department or in the organization where the work was performed;
- submit to the department a qualification work prepared and accepted for defense with feedback from the scientific supervisor and a review at least one week before its defense in the EC;
- to arrive on time for the defense of the dissertation 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 not to certify the student as one who did not appear for the defense of the thesis without valid reasons, with subsequent expulsion from the university. If the student was not able to warn in advance about the impossibility of his attendance at the dissertation defense, but during the work period the EC provided the necessary supporting documents, the EC can postpone the date of the dissertation defense.

### **Academic Integrity Policy**

The policy and principles of academic integrity are defined in Chapter 3 of the Code of Honor of the National Technical University of Ukraine "Ihor Sikorsky Kyiv Polytechnic Institute". In the event of a violation of academic integrity, the situation will be considered in accordance with the procedures approved by the University and current regulatory documents.

### **Norms of ethical behavior**

Standards of ethical behavior of students and employees are defined in Chapter 2 of the Code of Honor of the National Technical University of Ukraine "Ihor Sikorskyi Kyiv Polytechnic Institute".

### **Types of control and rating system for evaluating learning outcomes (RSO)**

The result of the dissertation defense is formalized in the defense report. The master's thesis rating has two components. The first component characterizes the quality of the student's work during the preparation of the master's thesis for defense. The second component is determined by the examination committee during the meeting and takes into account the quality of the master's thesis and its defense.

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

Qualities of qualifying work (maximum 60 points):

1. Practical orientation of the work and scientific novelty of the work

*10 points*- the work was performed at the request of the enterprise, institution. The technical task was approved by the customer of the study. The work uses original ideas that were put forward by the student personally (according to the feedback of the scientific supervisor). An in-depth analysis of scientific and technical results from the point of view of reliability, scientific and practical value was carried out.

*8-9 points*- the work was carried out within the framework of a farm contract or state contract. The task is agreed with the customer of the topic. The research was carried out on the basis of known approaches, but at the same time a final solution to the problem was obtained. The obtained results were assessed in terms of the possibilities of their use in scientific and practical activities.

*6-7 points*- the work was performed in the interests of the educational process of the department. Didactic requirements are approved by the head of the department. The work demonstrated the ability to conduct scientific research under supervision and draw correct conclusions.

*0 points*- the work does not have a practical orientation. The research was carried out on the basis of

known approaches, but at the same time, the final solution to the problem that was posed was not obtained.

## 2. Structure of work. Justification of the purpose of the research and research method

*10 points*– the object, subject and relevance of the research goal are reasonably defined. The analysis of the state of the problem was carried out according to the latest domestic and foreign sources. Conducted patent studies. Admissible research methods are considered in depth, according to many criteria. The choice of theoretical and experimental methods of research was made on the basis of approaches of system analysis.

*8-9 points*- the definition of the object, subject and relevance of the research goal is arguably insufficient. The analysis of the state of the problem was carried out mainly based on domestic sources without the use of periodical scientific and technical publications. Conducted patent studies based on domestic sources. Several possible theoretical and/or experimental research methods are considered. Based on one of the criteria, the best method was selected.

*6-7 points*- the definition of the object, subject and relevance of the research goal is arguably insufficient. The analysis of the state was carried out mainly based on educational literature and outdated sources (more than 10 years). The choice of the research method was made on the basis of a qualitative comparison of at least two options.

*0 points*– the object, subject of research is not defined. The relevance of the purpose of the research is insufficiently argued. The choice of the research method was made without sufficient justification.

## 3. Depth of theoretical substantiation, research and modeling of objects. The level of the experiment

*10 points*– the mathematical method of solving the research tasks is reasonably chosen. Boundary and initial conditions are correctly defined. The modeling method was reasonably chosen. An analysis of the adequacy of the developed model was carried out. An original experimental method has been developed or an experimental setup has been created. The research was carried out at the modern technical and methodical level. Evaluation of measurement errors and comparative analysis of theoretical and experimental results was carried out.

*8-9 points*– the choice of mathematical research method, modeling method was made correctly, but without sufficient justification. The developed model is adequate for object research. The main assumptions are correct, but not sufficiently substantiated. The choice of the method of experimental research is sufficiently justified. The research was carried out at the modern technical and methodical level. Evaluation of measurement errors and comparative analysis of theoretical and experimental results was carried out.

*6-7 points*- the choice of mathematical research method, modeling method is not substantiated. Some assumptions are incorrect or unfounded. Demonstrated ability to qualitatively perform experimental research. An analysis of the results was carried out and conclusions were drawn. Or a practical test of the performance of the developed method, algorithm, program, etc. was carried out.

*0 points*- there is no theoretical justification of the research. The experiment (practical test) was not performed.



#### 4. The level of use of information technologies (for users)

*10 points-* the solution of the research tasks was carried out on the basis of the use of several modern programs (CAD / CAM / CAE / MatCAD / MatLab / LabView / Solid Works, etc.). The choice of programs is justified. The Internet was used to collect information from the research area.

*8-9 points-* at least one modern program or a program developed independently by means of object-oriented programming is used when solving research tasks. The use of information technologies made it possible to significantly raise the level of solving research problems.

*6-7 points-* information technologies are used to perform basic calculations and at the level of using office technologies.

*0 points-* information technologies are not used to solve basic work issues.

#### 5. The quality of the design of the work and illustrative material

*10 points-* the material is presented clearly, concisely, clearly, the design of the work fully meets the current requirements. Text material, all illustrations and tables are made using text and graphic editors. Illustrative material fully, with high clarity, reveals the main provisions of the work that are submitted for protection. The material is made using modern graphic packages in compliance with the requirements of regulatory documents.

*8-9 points-* the material is presented clearly and concisely, but there are stylistic errors. Text material, all illustrations and tables are made using text and graphic editors. Illustrative material fully, but with insufficient clarity, reveals the main provisions of the work. The material is made using modern graphic packages, there are minor deviations from the requirements of regulatory documents.

*6-7 points-* unclear presentation of the material, there are grammatical errors. Registration with violations of the requirements of regulatory documents. Illustrative material does not fully and with insufficient visibility reveal the main provisions of the work

*0 points-* the structure and design of the work do not meet the requirements. Illustrative material does not reveal the main provisions of the work.

#### 6. Implementation of work materials

*10 points-* one of the conditions is fulfilled (documents, materials or their copies confirming fulfillment are attached):

- received a patent of Ukraine or a positive decision on an invention, industrial design, utility model;
- the results of the work are implemented or accepted for implementation according to relevant acts;
- published several scientific articles in specialized scientific publications or made several reports at scientific conferences (republican, international).

*8-9 points-* one of the conditions is fulfilled (documents, materials or their copies confirming fulfillment are attached):

- an application for a patent of Ukraine for an invention, industrial design, utility model or object of industrial property has been submitted;
- published an article in a scientific journal;
- a report was made at a scientific conference (republican, international);
- the results of the work are accepted for use in the educational process according to the act.

*6-7 points-* one of the conditions is fulfilled (documents, materials or their copies confirming fulfillment are attached):

- a certificate on the rationalization proposal was drawn up;
- a report was made at the city (university) scientific conference;
- published an article in a scientific journal, collection;
- the article has been accepted for publication in a scientific journal.

*0 points*- There is no implementation of the results.

Defense of qualifying work (maximum 40 points)

36-40 points – a high level of quality of the report, fully masters the material, perfectly justifies the decisions made. The student knows how to defend his opinion.

*31-35 points*- the level of the quality of the answer is above average, slight gaps in mastery of the material are allowed. The student well substantiates the decisions made and knows how to defend his opinion.

*24-30 points*- the average level of the quality of the student's answer. He does not know the material well enough, the average degree of substantiation of the decisions made, he does not know how to defend his opinion well enough.

*0 points*- low level of response quality. The student does not have a good command of the material, does not justify the decisions made and does not know how to defend his opinion.

Table of correspondence of rating points to grades on the university scale:

<b>Scores</b>	<b>Rating</b>
100-95	Perfectly
94-85	Very good
84-75	Fine
74-65	Satisfactorily
64-60	Enough
Less than 60	Unsatisfactorily
The work has not been submitted to examination board or does not meet the requirements for master's theses	Not allowed

## **8. Working program of the academic discipline (syllabus):**

**Folded**, Ph.D., prof. Stefan Volodymyrovych Zaichenko

Approved by the Department of Automation of Electrical and Mechatronic Complexes  
(Protocol № 21 of 26.06.2024)

Approved by the Methodical Commission of the IEE Institute (Protocol № 18 of 24.06.2024)