NATIONAL TECHNICAL UNIVERSITY OF UKRAINE
"IGOR SIKORSKY KYIV POLYTECHNIC INSTITUTE"
Educational and Scientific Institute of Energy Saving and Energy Management

APPROVED:
by the Methodological Council of the Igor Sikorsky Kyiv Polytechnic Institute
(minutes of meeting No. 5 dated February 23, 2023)

F – CATALOG
ELECTIVE EDUCATIONAL DISCIPLINES
CYCLE OF PROFESSIONAL TRAINING

second (master's) level of higher education
according to the educational and professional program
Engineering of Intellectual Electrotechnical and Mechatronic Complexes
in specialty 141 Electric Power Engineering, Electrotechnics and Electromechanics

ADOPTED:
of the Educational and scientific institute
of energy saving and energy management
(Minutes of meeting No. 6 dated January 31, 2023)

KYIV 2023

Entry

In accordance with Section X of Article 62 of the Law of Ukraine "On Higher Education" (No. 1556-VII of 01.07.2014), elective disciplines are disciplines of free choice of students for the second (master's) level of higher education, aimed at providing general and special (professional) competencies in the specialty. The volume of elective disciplines is at least 25% (23 ECTS credits) of the total number of ECTS credits (90 ECTS credits) provided for the second level of higher education.

Detailed information on the rules and procedure for choosing educational components by students is provided in the Regulations on the implementation of the right to free choice of academic disciplines by applicants for higher education of Igor Sikorsky Kyiv Polytechnic Institute. Igor Sikorsky. The text of the document is available at the link https://osvita.kpi.ua/node/185.

To familiarize the applicant with the list of disciplines of free choice, on the website of Igor Sikorsky Kyiv Polytechnic Institute. Igor Sikorsky (https://osvita.kpi.ua/) and on the website of the AEMC department there is a departmental catalog (F-catalog) of elective disciplines (https://aemk.kpi.ua/ choice-disciplines), which presents disciplines of free choice. The choice of applicants is implemented through the specialized information system of the University for the spring academic semester.

The choice of disciplines from the F-Catalogs by students of the second (master's) RVO is carried out at the beginning of the autumn semester of the first year of study. The selected disciplines (5 disciplines: 3 disciplines of 5 ECTS credits, and 2 disciplines of 4 ECTS credits) will be studied in the spring semester of the same year of study. The results of the selection are used to form individual curricula.

At the written request of the applicant, it is possible to recalculate the learning outcomes of elective disciplines in accordance with the Regulations on recognition in Igor Sikorsky Kyiv Polytechnic Institute. Igor Sikorsky of the results of previous training or the Regulations on recognition in KPI. Igor Sikorsky Learning Outcomes Acquired in Non-Formal/Informal Education

Students have the opportunity to choose disciplines of the certificate programs "Engineering and Automation of Hydrogen Energy Systems and Technologies" and "Engineering and Automation of Fuel and Energy Systems and Bioenergy Technologies". The educational components of the certificate programs consist of elective disciplines of the second (master's) level of higher education in the specialty 141 "Electric Power Engineering, Electrical Engineering and Electromechanics" with a total of 23 ECTS credits. With a detailed description Certificate programs can be found at the link https://aemk.kpi.ua/c Certificate Programs/.

Registration for programs takes place during the period of students' exercise of the right to free choice of academic disciplines for the 2nd semester. Registration of external students for the disciplines of the SP is provided by the AEMC department and is carried out for the entire volume of the SP through the submission of an appropriate application by external listeners, based on which the student is enrolled in the group for passing the SP.

Enrollment of students to the SP is carried out by order of the Deputy Director for Scientific and Pedagogical Work of the Educational and Research Institute of Energy Saving and Energy Management of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute".

Certificate programs “Engineering and Automation of Hydrogen Energy Systems and Technologies" and "Engineering and Automation of Fuel and Energy Systems and Bioenergy Technologies" for students of Igor Sikorsky Kyiv Polytechnic Institute. Igor Sikorsky Kyiv Polytechnic Institute can be implemented within the framework of the educational program "Engineering of Intelligent Electrical and Mechatronic Complexes", according to which he studies by forming an individual educational trajectory with the choice of all disciplines that are offered within the of this JV.

Content

* - Disciplines from the certificate program "Engineering and Automation of Hydrogen Energy Systems and Technologies"

** - Disciplines from the certificate program "Engineering and Automation of Fuel and Energy Systems and Bioenergy Technologies"

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Discipline	Computer Simulation of Processes in Electrical Systems
VO Level	Second (Master's)
Course	1 course (2)
Volume	according to the work plan
Language of instruction	English
Pulpit	Automation of electrotechnical and mechatronic complexes
Requirements to start studying	Electric Drive, Automated Electric Drive of Machines and Installations, Theory of Automatic Control of Electrotechnical Complexes and Mechatronic Systems
What will be studied	Within the discipline, the principles of working with software for computer modeling of electrical and mechatronic systems for various technological tasks are considered, the features of choosing the structure of an electric drive, the impact of changing the structure on the method of engineering calculations are determined.
Why it's interesting/should be studied	To form the student's skills in working with modern software for the calculation of complex electrical and mechatronic systems, the ability to take into account changes in operating parameters while driving, to choose the optimal system configuration for a particular technological task.
What you can learn (learning outcomes)	After studying the course, students are able to effectively reproduce processes in electric power, electrical and electromechanical systems when they are computer modeled.
How to use the acquired knowledge and skills (competences)	To design electric drive systems with open and closed speed control circuits, to calculate braking energy and resistors to prevent emergency modes, to build acceleration and braking curves of induction motors in robots from soft starters with different laws of voltage change.
Information support	Syllabus, teaching materials (lecture notes, presentations for lectures, workshops for practical classes), Google Class
Form of classes	Lectures, practical classes
Semester control	Exam

Discipline	Computer Simulation of Electric Drive Systems Using Engineering Software
VO Level	Second (Master's)
Course	1 course (2)
Volume	according to the work plan
Language of instruction	English
Pulpit	Automation of electrotechnical and mechatronic complexes
Requirements to start studying	Electrical Machines, Theory of Automatic Control of Electrical Complexes and Mechatronic Systems, Automated Electric Drive of Machines and Installations, Computer Engineering and Programming.
What will be studied	Within the framework of the discipline, the principles of operation of software for the selection of an electric drive, work with catalog data located in the "cloud", online - correction of the design results obtained, verification of the correctness of data input are considered.
Why it's interesting/should be studied	To form the student's skills in working with the software located on the WEB-server, the features of data entry
What you can learn (learning outcomes)	Master new versions or new software designed for computer modeling of objects and processes in electric power, electrotechnical and electromechanical systems
How to use the acquired knowledge and skills (competences)	To create universal and most effective algorithms for modeling the processes of electrical complexes and to conduct their research on modern equipment with modern software.
Information support	Syllabus, teaching materials (lecture notes, presentations for lectures, workshops for practical classes), Google Class
Form of classes	Lectures, practical classes
Semester control	Exam

Discipline	Intelligent Automatic Control Systems for Electrical Complexes
VO Level	Second (Master's)
Course	1 course (2)
Volume	according to the work plan
Language of instruction	English
Pulpit	Automation of electrotechnical and mechatronic complexes
Requirements to start studying	Electrical Machines, Theory of Automatic Control of Electrotechnical Complexes and Mechatronic Systems, Automated Electric Drive of Machines and Installations, Computer Engineering and Programming, Digital and Nonlinear Control Systems of Electrotechnical Complexes
What will be studied	Problems of Intelligent Automatic Control Systems of Electrotechnical Complexes, the Concept of Linguistic Variable and Membership Function, Construction of Regulators on the Basis of Fuzzy Logic, Defuzzification of Fuzzy Sets of FC. Features of ISAC construction using neural networks (NM) for electrotechnical complexes.
Why it's interesting/should be studied	Acquire skills to synthesize automatic control systems based on fuzzy logic, neural and hybrid networks, genetic algorithms; build algorithms for the functioning of neural networks in the process of learning weighting coefficients; apply numerical integration in solving problems of mathematical modeling.
What you can learn (learning outcomes)	- know the basic laws of transition from the actual values of the variables of the state of the system to the linguistic ones used in fuzzy logic systems; – know the basic algorithms for fuzzification of fuzzy variables; – know the models of learning the weighting coefficients of artificial neural networks
How to use the acquired knowledge and skills (competences)	Ability to build control systems for electrical complexes based on fuzzy logic; to create universal algorithms for the study of intelligent systems using artificial neural networks.
Information support	Syllabus, teaching materials (lecture notes, presentations for lectures, workshops for practical classes), Google Class
Form of classes	Lectures, laboratory and practical classes
Semester control	Exam

Discipline	Technical risks
VO Level	Second (Master's)
Course	1 course (2)
Volume	according to the work plan
Language of instruction	English
Pulpit	Automation of electrotechnical and mechatronic complexes
Requirements to start studying	Higher Mathematics, General Physics, Occupational Health and Safety.
What will be studied	Conditions for Preventing Risk Situations of Mechatronic Systems of Energy-Intensive Production
Why it's interesting/should be studied	To form the abilities of a specialist to prevent emergency work of modern production, professionally solve production problems and navigate the methods of drawing up a risk monitoring plan for specific technologies of mechatronic systems
What you can learn (learning outcomes)	Theoretical and practical aspects of industrial and environmental safety management based on the analysis, assessment and prevention of risk situations at work. Abilities: calculate the main risks of using electromechanical systems; making engineering decisions on a set of issues of functioning, research of the main risks; computer modeling, design and operation of electromechanical equipment used in industry, transport and construction
How to use the acquired knowledge and skills (competences)	Competently produce new ideas in this field, independently solve the issues of selection, configuration and operation of mechatronic systems or individual devices of monitoring systems without risky operation of technological equipment, choose the best engineering solutions to technical problems based on their system analysis.
Information support	Syllabus, teaching materials (lecture notes, presentations for lectures, workshops for practical classes), Google Class
Form of classes	Lectures, practical classes
Semester control	Passed

Discipline	Risk Management Plan energy-intensive industries
VO Level	Second (Master's)
Course	1 course (2)
Volume	according to the work plan
Language of instruction	English
Pulpit	Automation of electrotechnical and mechatronic complexes
Requirements to start studying	Higher Mathematics, General Physics, Occupational Health and Civil Protection
What will be studied	• Physical foundations of the theory of determining the technical risks of electromechanical equipment; peculiarities of the occurrence of risk situations during the operation of electromechanical equipment; fundamentals of design of installations with a reduced risk of accidents; scientific and technical directions and reduction of risk situations, environmental protection and labor protection.
Why it's interesting/should be studied	To be able to solve the technical problems that a specialist must demonstrate when drawing up a risk management plan for the site, workshop, and entire production.
What you can learn (learning outcomes)	Methodological ***and methodical issues of calculation of technical, operational, environmental and economic*** risks of potentially hazardous objects of the technosphere. Understand the basics of the theory of technical risks in the study of the main parameters, computer modeling, design and operation of electromechanical equipment used in industry, transport and construction.
How to use the acquired knowledge and skills (competences)	In calculations for the design of installations, the selection of main and auxiliary equipment to prevent risk situations. Determination of non-emergency mode of operation and indicators of equipment functioning. Research and determination of the effectiveness of reducing the risk modes of operation of installations.
Information support	Syllabus, teaching materials (lecture notes, presentations for lectures, workshops for practical classes), Google Class
Form of classes	Lectures, practical classes
Semester control	Passed

Discipline	Theoretical and practical aspects of conducting scientific work
VO Level	Second (Master's)
Course	1 course (2)
Volume	according to the work plan
Language of instruction	English
Pulpit	Automation of electrotechnical and mechatronic complexes
Requirements to start studying	Higher Mathematics, General Physics, Occupational Health and Civil Protection
What will be studied	Comparison with the world level of scientific achievements and study of advanced achievements within the framework of his master's thesis. Methodology of scientific research. Collection and analysis of the advantages and disadvantages of well-known foreign and domestic innovative achievements, over the past 20 years for the five leading countries in the industry. Development of innovative R&D proposals for the modernization of well-known similar mechatronic systems.
Why it's interesting/should be studied	The subject of study is the formation of theoretical knowledge on the physical foundations, theory and principles of operation of electromechanical equipment; features of the design of installations and machines; the procedure for the operation of installations; requirements of safety rules, arrangement and technical operation; fundamentals of plant design; scientific and technical directions of reducing the part of manual labor, environmental protection and labor protection and practical skills, technically correct and economically justified selection of installations and measurement of their main operating parameters.
What you can learn (learning outcomes)	Use modern methods of scientific analysis of innovative achievements on the topic of master's work; engineering calculations of the main blocks and assemblies of the object of study; justify the choice of optimal operating parameters of electromechanical systems; make decisions on a set of issues of functioning; carry out computer modeling, design of electromechanical equipment used in industry, transport and construction.
How to use the acquired knowledge and skills (competences)	In calculations for the design of installations, the selection of main and auxiliary equipment to prevent risk situations. Determination of non-emergency mode of operation and indicators of equipment functioning. Research and determination of the effectiveness of reducing the risk modes of operation of installations.
Information support	Syllabus, teaching materials (lecture notes, presentations for lectures, workshops for practical classes), Google Class
Form of classes	Lectures, practical classes
Semester control	Passed

Discipline	Energy-Saving Intelligent Machines and Equipment for Electromechanical and Mechatronic Systems
VO Level	Second (Master's)
Course	1 course (2)
Volume	according to the work plan
Language of instruction	English
Pulpit	Automation of electrotechnical and mechatronic complexes
Requirements to start studying	Electrical Machines, Computer Engineering and Programming, Automated Electric Drive of Machines and Installations, Digital and Nonlinear Control Systems of Electrotechnical Complexes
What will be studied	Elements of the theory of electromechanical and mechatronic systems with intelligent control under conditions of rational energy distribution and introduction of innovative energy-saving machines and equipment.
Why it's interesting/should be studied	To form the skills and abilities of engineering and scientific activities to solve professional problems of development and operation of electromechanical and mechatronic systems with intelligent control based on information technology.
What you can learn (learning outcomes)	In the process of mastering the discipline, students learn: to use system analysis for the development and design of innovative technical ideas and to program their structure and justify parameters using the programming languages AutoLISP and C#.
How to use the acquired knowledge and skills (competences)	After mastering the discipline, students are able to navigate in technical literature using modern information technologies, propose and formalize innovative technical ideas, independently conduct research on electromechanical and mechatronic systems, parameterize structural elements and justify their parameters for computer programming, select the structures of two-layer neural networks and their logistic functions, select, configure and operate machines and Mechatronic control equipment using modern engineering methods.
Information support	Syllabus, teaching materials (lecture notes, presentations for lectures, workshops for practical classes), Google Class
Form of classes	Lectures, practical and laboratory classes
Semester control	Exam

Discipline	Adaptive complexes of electromechanical and mechatronic systems
VO Level	Second (Master's)
Course	1 course (2)
Volume	according to the work plan
Language of instruction	English
Pulpit	Automation of electrotechnical and mechatronic complexes
Requirements to start studying	Electrical Machines, Computer Engineering and Programming, Automated Electric Drive of Machines and Installations, Digital and Nonlinear Control Systems of Electrotechnical Complexes
What will be studied	Elements of the Theory of Adaptive Electromechanical and Mechatronic Systems under the Conditions of Ensuring Rational Energy Distribution and the Introduction of Innovative Energy-Saving Machines and Equipment.
Why it's interesting/should be studied	To form the skills and abilities of engineering and scientific activities to solve professional problems of development and operation of adaptive electromechanical and mechatronic systems based on information technology.
What you can learn (learning outcomes)	In the process of mastering the discipline, students learn: to use system analysis to develop and design innovative technical ideas; independently conduct research of adaptive systems of electromechanical complexes and mechatronic facilities with the possibility of automation; configure and select adaptive modes of operation of machines and equipment with mechatronic control.
How to use the acquired knowledge and skills (competences)	After mastering the discipline, students are able to navigate in technical literature using modern information technologies, propose and formalize innovative technical ideas, independently conduct research on adaptive electromechanical and mechatronic systems, parameterize structural elements and justify their parameters for computer programming, select, configure and operating modes of machines and equipment with mechatronic control using modern engineering methods.
Information support	Syllabus, teaching materials (lecture notes, presentations for lectures, workshops for practical classes), Google Class
Form of classes	Lectures, practical and laboratory classes
Semester control	Exam

Discipline	Pattern Recognition Methods
VO Level	Second (Master's)
Course	1 course (2)
Volume	according to the work plan
Language of instruction	English
Pulpit	Automation of electrotechnical and mechatronic complexes
Requirements to start studying	Electrical Machines, Computer Engineering and Programming, Automated Electric Drive of Machines and Installations, Higher Mathematics, General Physics
What will be studied	Methods of pattern recognition in different systems; tasks for which pattern recognition methods are used.
Why it's interesting/should be studied	The development of transport systems precedes the development of the main technologies of the world economy. The main criterion for the quality of transport systems is the level of energy efficiency of the selected technology.
What you can learn (learning outcomes)	After studying the course, students are able to: - perform a formalized description of the tasks; - develop an algorithm for solving the problem based on the most suitable way of pattern recognition; - possess mathematical and algorithmic apparatus used in solving recognition problems.
How to use the acquired knowledge and skills (competences)	Set tasks and develop algorithms for their solution, use the necessary methods of pattern recognition, implement selected or developed algorithms
Information support	Syllabus, teaching materials (lecture notes, presentations for lectures, workshops for practical classes), Google Class
Form of classes	Lectures, workshops and laboratory classes
Semester control	Passed

Discipline	Fundamentals of the Theory of Technical Diagnostics
VO Level	Second (Master's)
Course	1 course (2)
Volume	according to the work plan
Language of instruction	English
Pulpit	Automation of electrotechnical and mechatronic complexes
Requirements to start studying	Electrical Machines, Computer Engineering and Programming, Automated Electric Drive of Machines and Installations, Higher Mathematics, General Physics
What will be studied	• Theoretical foundations of technical diagnostics; Practical skills in the use of non-destructive testing methods to assess the technical condition of electrical and mechatronic complexes.
Why it's interesting/should be studied	The study of the discipline will allow: - modern methods of assessment of the technical condition of the main electrical equipment of enterprises in the energy sector. - use the skills of using modern diagnostic methods.
What you can learn (learning outcomes)	Modern methods for assessing the technical condition of electrical equipment of energy industry enterprises. Justify the choice of diagnostic parameters and method for diagnosing electrical equipment. Evaluate the effectiveness and reliability of diagnostic results.
How to use the acquired knowledge and skills (competences)	The acquired knowledge and skills will allow you to design and maintain the electrical part of transport and energy storage systems.
Information support	Syllabus, teaching materials (lecture notes, presentations for lectures, workshops for practical classes), Google Class
Form of classes	Lectures, workshops and laboratory classes
Semester control	Passed

Discipline	Statistical Methods for Recognition and Separation of Diagnostic Parameters
VO Level	Second (Master's)
Course	1 course (2)
Volume	according to the work plan
Language of instruction	English
Pulpit	Automation of electrotechnical and mechatronic complexes
Requirements to start studying	Electrical Machines, Computer Engineering and Programming, Automated Electric Drive of Machines and Installations, Higher Mathematics, General Physics
What will be studied	Methods of separation of diagnostic signs in space. Fundamentals of Information Theory.
Why it's interesting/should be studied	Obtaining basic knowledge in the field of modern diagnostics theory will allow students to develop new effective systems for determining the technical condition of electrical complexes.
What you can learn (learning outcomes)	After completing the course, students are able to use: Linear separation methods; Separation in the diagnostic space; Methods of stachostic approximation; Determine the diagnostic value of parameters.
How to use the acquired knowledge and skills (competences)	Evaluate the parameters of the developed technical diagnostics system; To assess the diagnostic value of the results of the study of the state of electrical complexes
Information support	Syllabus, teaching materials (lecture notes, presentations for lectures, workshops for practical classes), Google Class
Form of classes	Lectures, practical and laboratory classes
Semester control	Passed

Discipline	Efficiency Management of Energy Use of Electrical Complexes
VO Level	Second (Master's)
Course	1 course (2)
Volume	according to the work plan
Language of instruction	English
Pulpit	Automation of electrotechnical and mechatronic complexes
Requirements to start studying	Electrical Machines, Computer Engineering and Programming, Automated Electric Drive of Machines and Installations, Modeling of Electrical and Mechatronic Systems, Higher Mathematics, General Physics
What will be studied	Methods and means of evaluation of technological solutions for improving energy efficiency, composition and requirements of regulatory and technical documentation in the field of energy efficiency, as well as methods for creating models for the analysis of energy efficiency and energy efficiency criteria for the management of electrical complexes.
Why it's interesting/should be studied	To form the basic abilities to apply an integrated approach to solving multi-criteria problems of energy efficiency management , energy control modes and selection of electrical equipment of electrical complexes.
What you can learn (learning outcomes)	After completing the course, students should: - know the main provisions of the Energy Strategy of Ukraine and the principles of energy security; - know the main effective methods and approaches aimed at improving the energy efficiency and reliability of electric power, electrical and electromechanical equipment and related complexes and systems.
How to use the acquired knowledge and skills (competences)	Ability to demonstrate awareness and ability to use regulations, norms, rules and standards in the electric power industry, electrical engineering and electromechanics. Ability to optimize technological processes and build structural diagrams of automated control systems. Ability to create universal and most effective algorithms for modeling processes in electrical systems and to conduct their research.
Information support	Syllabus, teaching materials (lecture notes, presentations for lectures, workshops for practical classes), Google Class
Form of classes	Lectures, laboratory classes
Semester control	Exam

Discipline	Optimization of control modes and selection of electrical equipment of electrical complexes
VO Level	Second (Master's)
Course	1 course (2)
Volume	according to the work plan
Language of instruction	English
Pulpit	Automation of electrotechnical and mechatronic complexes
Requirements to start studying	Electrical Machines, Theory of Automatic Control of Electrical Complexes and Mechatronic Systems, Automated Electric Drive of Machines and Installations, Modeling of Electrical and Mechatronic Systems, Higher Mathematics, General Physics
What will be studied	Analytical review of the existing directions of optimization of energy modes of operation of the complex – load unit, semiconductor converter, electromechanical converter, mechanical converter, actuator. Simulation and optimization mathematical models. Implementation of energy-efficient modes.
Why it's interesting/should be studied	To form the basic abilities to apply an integrated approach to solving multi-criteria problems of optimization of energy control modes and selection of electrical equipment of electrical complexes.
What you can learn (learning outcomes)	After studying the course, students are able to produce new ideas (creativity); able to search, process and analyze information from various sources; are capable of professional formulation and solution of complex multi-criteria optimization problems, implementation of energy-efficient modes.
How to use the acquired knowledge and skills (competences)	Formulation of verbal optimization algorithms, formalization of verbal algorithms. Creation of simulation and mathematical models for optimization of control modes and selection of electrical equipment of electrical complexes. Knowledge of the methodology for assessing the energy efficiency of the complex - load unit, semiconductor converter, electromechanical converter, mechanical converter, executive body.
Information support	Syllabus, teaching materials (lecture notes, presentations for lectures, workshops for practical classes), Google Class
Form of classes	Lectures, laboratory classes
Semester control	Exam

Discipline	Optimization of modes of electric power systems
VO Level	Second (Master's)
Course	1 course (2)
Volume	according to the work plan
Language of instruction	English
Pulpit	Automation of electrotechnical and mechatronic complexes
Requirements to start studying	Electrical Machines, Theory of Automatic Control of Electrical Complexes and Mechatronic Systems, Automated Electric Drive of Machines and Installations, Modeling of Electrical and Mechatronic Systems, Higher Mathematics, General Physics
What will be studied	The purpose and objectives of the discipline are to promote the formation of ideas about the optimal modes of operation of the main electrical equipment of electrical systems: generators, synchronous compensators, power transformers and autotransformers, switching equipment, measuring transformers, neutral operating modes.
Why it's interesting/should be studied	To form the basic abilities to apply an integrated approach to solving multi-criteria problems of optimization of energy control modes and selection of electrical equipment of electrical complexes.
What you can learn (learning outcomes)	As a result of mastering the discipline, the student should: know: - composition of the main electrical equipment of power plants and electric power systems and its parameters; - electrical diagrams of switchgears and longwall diagrams of power plants; - influence of operating modes of electrical equipment on the nature of stable and transient processes in electric power systems; - operating modes of synchronous generators, synchronous and asynchronous electric motors, criteria for stable operation
How to use the acquired knowledge and skills (competences)	Readiness to operate, test and repair technological equipment of the electric power and electrical industries; ability to make decisions in the field of electric power and electrical engineering, taking into account energy and resource saving; ability to determine effective production and technological modes of operation of electric power and electrical engineering facilities.
Information support	Syllabus, teaching materials (lecture notes, presentations for lectures, workshops for practical classes), Google Class
Form of classes	Lectures, laboratory classes
Semester control	Exam

Discipline	**Systems for automating engineering calculations of electric drive**
VO Level	First (bachelor's)
Course	1 year (2 semester)
Volume	according to the work plan
Language of instruction	English
Pulpit	Automation of electrotechnical and mechatronic complexes
Requirements to start studying	Electric Drive, Theory of Automatic Control of Electrotechnical Complexes and Mechatronic Systems, Automated Electric Drive of Machines and Installations, Modeling of Electrical and Mechatronic Systems, Higher Mathematics, General Physics
What will be studied	The purpose of studying the discipline is to get acquainted with the state and prospects of the development of modern computer systems for the design of electromechanical systems using the bases of modern converter devices from leading manufacturers of electric drives. Much attention is paid to the peculiarities of the implementation of the design procedure using the German-made Drive Solution Designer (CAE system) software.
Why it's interesting/should be studied	The discipline acquaints students with the software and means of constructing electromechanical systems of alternating current by methods that are based on the theory of electric drive and the principles of building control systems for electric drives.
What you can learn (learning outcomes)	Apply application software, microcontrollers and microprocessor technology to solve practical problems in professional activities; analyze processes in electric power, electrical and electromechanical equipment, relevant complexes and systems; be able to solve complex specialized problems in the design and maintenance of electromechanical systems, electrical equipment of power plants, substations, systems and networks; use, calculate and investigate digital and non-linear process controllers using modern electrical equipment.
How to use the acquired knowledge and skills (competences)	Ability to solve practical problems using computer-aided design and calculation (CAD) systems; ability to solve complex specialized tasks and practical problems related to the development of automatic control systems, to evaluate the accumulated experience
Information support	Syllabus, teaching materials (lecture notes, presentations for lectures, workshops for practical classes), Google Class
Form of classes	Lectures and workshops
Semester control	Exam

Discipline	**Computer Control Systems for Thermochemical and Electrochemical Processes of Hydrogen Production***
VO Level	Second (Master's)
Course	1 year (2 semester)
Volume	according to the work plan
Language of instruction	English
Pulpit	Automation of electrotechnical and mechatronic complexes
Requirements to start studying	Higher Mathematics, General Physics, Computer Science and Programming, Thermodynamics and Heat Transfer, Theoretical Foundations of Electrical Engineering, etc.
What will be studied	Microprocessor Automation Systems and Features of Their Use in Real-Time Systems
Why it's interesting/should be studied	The purpose of studying the discipline is the formation of students' theoretical knowledge and practical skills in the use of programmable controllers in solving problems of synthesis of control systems for thermochemical and electrochemical processes of hydrogen fuel extraction.
What you can learn (learning outcomes)	To develop automation schemes for thermochemical and electrochemical processes of hydrogen production based on programmable logic controllers
How to use the acquired knowledge and skills (competences)	Ability to solve complex specialized tasks and practical problems related to software control of thermochemical and electrochemical processes of hydrogen production.
Information support	Syllabus, textbook, textbooks, reference sources, methodological support (manuals) for practical classes
Form of classes	Lectures and practical classes
Semester control	Exam

Discipline	**Technical Regulation, Standardization and Certification in the Energy Sector****
VO Level	Second (Master's)
Course	1 year (2 semester)
Volume	according to the work plan
Language of instruction	English
Pulpit	Automation of electrotechnical and mechatronic complexes
Requirements to start studying	Higher Mathematics, General Physics, Computer Science and Programming, Thermodynamics and Heat Transfer, Theoretical Foundations of Electrical Engineering, etc.
What will be studied	The system of technical regulation of relations in the field of establishment, application and fulfillment of mandatory requirements for the products of the fuel and energy complex, in particular, hydrogen as a fuel, as well as related technological processes, systems, complexes, services and personnel.
Why it's interesting/should be studied	The purpose of studying the discipline is to provide students with theoretical knowledge and practical skills regarding the organizational and methodological foundations of technical regulation, standardization and certification in the field of energy, in particular, alternative energy, at the national, regional and international levels.
What you can learn (learning outcomes)	To develop and practically apply technical and technological systems, regulations, regulatory documents of various categories for the circulation of safe products in the energy market. Develop conformity assessment systems, certification schemes, quality control systems. Design testing laboratories for conformity assessment of energy products
How to use the acquired knowledge and skills (competences)	Ability to solve complex specific practical problems and tasks related to ensuring uninterrupted circulation of safe products of the fuel and energy complex (motor and other energy fuels, lubricants, technical fluids, etc.) in various sectors of the economy.
Information support	Syllabus, textbook, textbooks, reference sources, methodological support (manuals) for practical classes
Form of classes	Lectures and practical classes
Semester control	Exam

Discipline	**Simulation of Electrochemical and Thermal Processes in Hydrogen Production***
VO Level	Second (Master's)
Course	1 year (2 semester)
Volume	according to the work plan
Language of instruction	English
Pulpit	Automation of electrotechnical and mechatronic complexes
Requirements to start studying	Theoretical Foundations of Electrical Engineering, Computer Engineering and Programming, Theory of Automatic Control, Automated Electric Drive of Machines and Installations, Digital and Nonlinear Control Systems of Electrical Complexes.
What will be studied	Synthesis and analysis of mathematical models of electrochemical and thermal processes in hydrogen production, typical automatic control algorithms, regulators and nonlinear elements.
Why it's interesting/should be studied	To form the basic abilities to apply an integrated approach to solving the problems of modeling electrochemical and thermal processes in the production of hydrogen.
What you can learn (learning outcomes)	Select and apply appropriate methods of analysis and synthesis of electrochemical and thermal processes in the production of hydrogen with specified indicators.
How to use the acquired knowledge and skills (competences)	Ability to carry out research of electrochemical and thermal processes in the production of hydrogen by digital modeling methods using standard packages and means of automation of engineering calculations, to conduct experiments according to specified methods with processing and analysis of results.
Information support	Syllabus, textbook, textbooks, reference sources, methodological support (manuals) for practical classes
Form of classes	Lectures and practical classes
Semester control	Passed

Discipline	**Technology of energy production from traditional raw materials and in alternative energy sources****
VO Level	Second (Master's)
Course	1 year (2 semester)
Volume	according to the work plan
Language of instruction	English
Pulpit	Automation of electrotechnical and mechatronic complexes
Requirements to start studying	General Physics, Higher Mathematics
What will be studied	The technology of energy production using traditional raw materials (nuclear fuel, coal, oil, gas, etc.) and in alternative or renewable (non-traditional) energy sources using the energy of the sun, wind, heat of the Earth's interior, biomass, water (small hydropower) will be studied.
Why it's interesting/should be studied	It is necessary to study this because the world scientific and technological community is constantly looking for ways to increase the efficiency of energy production from traditional raw materials and in alternative energy sources
What you can learn (learning outcomes)	Know the principles of operation of bioenergy, wind power, hydropower, solar energy sources and sources using traditional raw materials.
How to use the acquired knowledge and skills (competences)	Ability to solve complex specialized and practical problems related to the problems of production, transmission of energy produced from traditional raw materials and in alternative energy sources.
Information support	Syllabus, textbook, textbooks, reference sources, methodological support (manuals) for practical classes
Form of classes	Lectures and practical classes
Semester control	Passed

Discipline	**Infrastructure of hydrogen production and storage technologies for energy and transport***
VO Level	Second (Master's)
Course	1 year (2 semester)
Volume	according to the work plan
Language of instruction	English
Pulpit	Automation of electrotechnical and mechatronic complexes
Requirements to start studying	Transport Systems of Electromechanical Complexes, Energy and Resource Saving Installations, Thermodynamics and Heat Transfer, etc.
What will be studied	Raw material base, technological processes and devices for hydrogen production, analysis of hydrogen production methods and their economic efficiency, analysis of infrastructure for hydrogen storage and transportation.
Why it's interesting/should be studied	The main task of the development of hydrogen energy facilities when using renewable energy sources as primary energy resources is to study the optimal structuring and functioning of power equipment based on various types of renewable energy sources, equipment for the production, storage and use of hydrogen, as well as the energy system as a whole, taking into account integration into the energy supply and energy consumption system.
What you can learn (learning outcomes)	Develop and implement systems for the accumulation, storage, transportation and use of hydrogen of various types and capacities in traditional energy for the accumulation of peak electricity.
How to use the acquired knowledge and skills (competences)	Ability to solve complex specialized tasks and practical problems related to the production, accumulation and storage of hydrogen for energy and transport.
Information support	Syllabus, textbook, textbooks, reference sources, methodological support (manuals) for practical classes
Form of classes	Lectures and practical classes
Semester control	Exam

Discipline	**Fundamentals of Rational Use of Traditional and Alternative Fuel and Energy Resources****
VO Level	Second (Master's)
Course	1 year (2 semester)
Volume	according to the work plan
Language of instruction	English
Pulpit	Automation of electrotechnical and mechatronic complexes
Requirements to start studying	Transport Systems of Electromechanical Complexes, Energy and Resource Saving Installations, Thermodynamics and Heat Transfer, etc.
What will be studied	Rational use system; methodological, technical and technological bases; physicochemical, operational and environmental properties of hydrogen as a fuel and other fuels and lubricants (FL; a quality control system for hydrogen, other energy fuels and lubricants in close relationship with the essence of technological processes of extraction, preparation for transportation after extraction, transportation, processing and further use of fuels and lubricants in energy and transport.
Why it's interesting/should be studied	The purpose of studying the discipline is to provide students with theoretical knowledge and practical skills regarding the classification of fuels and lubricants, the relationship between the composition, operational and environmental properties of fuels and lubricants, physical and chemical processes that occur during the use of fuels and lubricants, determining the most important physicochemical, operational and environmental indicators of fuels and lubricants to substantiate optimal technological processes, operational conditions for rational use
What you can learn (learning outcomes)	Develop, implement and operate systems for the rational use of traditional and alternative fuel and energy resources, taking into account their full life cycle from extraction, production to direct use by the consumer and utilization.
How to use the acquired knowledge and skills (competences)	Ability to solve complex universal practical problems and tasks of the energy market, fuel supply systems of economic sectors directly related to technological processes, properties, quality and methodology of rational use of fuels, oils, lubricants and technical fluids during the operation of equipment
Information support	Syllabus, textbook, textbooks, reference sources, methodological support (manuals) for practical classes
Form of classes	Lectures and practical classes
Semester control	Exam

Discipline	**Hydrogen Transport Technologies***
VO Level	Second (Master's)
Course	1 year (2 semester)
Volume	according to the work plan
Language of instruction	English
Pulpit	Automation of electrotechnical and mechatronic complexes
Requirements to start studying	Transport Systems of Electromechanical Complexes, Hydraulics and Hydropneumatic Drive, Electrical Machines and Technical Mechanics.
What will be studied	Description of the transport sector and the reasons why new technologies are becoming more accessible to the market; the basic principles of PEM fuel cell for a car; components related to the hydrogen system, from the high-pressure tank to the fuel cell; components related to an electric vehicle, from a fuel cell to an electric car; overview of the power unit as a system, taking into account safety aspects, schematic diagrams and chassis design; A description of vehicle maintenance, taking into account safety, routine maintenance, flowcharts, diagnostics and troubleshooting.
Why it's interesting/should be studied	The transport sector is currently the largest consumer of petroleum products, the second source of greenhouse gas emissions and remains an important source of emissions of pollutants: HC, NO, CO and fine particles. In response, manufacturers have improved the post-treatment of motor gases and are developing the use of alternative fuels, electricity and hydrogen as an energy source. Among these solutions, the combined use of hydrogen and PEM fuel cells offers two advantages: no local emissions and greater autonomy compared to batteries.
What you can learn (learning outcomes)	Build fuel cell powertrain components using appropriate safety devices for hydrogen transport technology.
How to use the acquired knowledge and skills (competences)	Ability to initiate troubleshooting scenarios through technical information analysis, observations, and measurements.
Information support	Syllabus, textbook, textbooks, reference sources, methodological support (manuals) for practical classes
Form of classes	Lectures and practical classes
Semester control	Passed

Discipline	**Theoretical Foundations and Applied Aspects of Bioenergy Technologies****
VO Level	Second (Master's)
Course	1 year (2 semester)
Volume	according to the work plan
Language of instruction	English
Pulpit	Automation of electrotechnical and mechatronic complexes
Requirements to start studying	Transport Systems of Electromechanical Complexes, Hydraulics and Hydropneumatic Drive, Electrical Machines and Technical Mechanics
What will be studied	Various organic substrates and technological methods of their processing, which are based on energy transformations of biological, biochemical and biophysical processes.
Why it's interesting/should be studied	The study of bioenergy contributes to the formation and development of natural scientific thinking, the structure of activity characteristic of a modern specialist in the field of electric power engineering, electrical engineering and electromechanics under conditions of sustainable development. At the same time, the principles of scientificity, accessibility, visibility, and connection of scientific knowledge are implemented.
What you can learn (learning outcomes)	Knowledge of trends and prospects for the development of the use of traditional and alternative energy sources, technologies for the production of bioethanol, biodiesel, biogas.
How to use the acquired knowledge and skills (competences)	Ability to select modern specific microbiological, biochemical and biotechnological methods in order to study metabolic processes in microorganisms of different systematic groups.
Information support	Syllabus, textbook, textbooks, reference sources, methodological support (manuals) for practical classes
Form of classes	Lectures and practical classes
Semester control	Passed

Discipline	**Integrated use of the resource base of traditional and renewable energy****
VO Level	Second (Master's)
Course	1 year (2 semester)
Volume	according to the work plan
Language of instruction	English
Pulpit	Automation of electrotechnical and mechatronic complexes
Requirements to start studying	General Physics, Electrical Machines, Electric Drive, Design of Elements of Electromechanical Systems
What will be studied	Estimation of the resource base of traditional and renewable energy in terms of volumes and energy intensity. The impact of the integrated use of energy resources on the efficiency of energy systems. Systems of integrated use, conversion, and storage of energy.
Why it's interesting/should be studied	Knowledge of energy capabilities, types and sources of energy carriers, integrated approaches to their use, transformation and construction of appropriate systems of electromechanical equipment.
What you can learn (learning outcomes)	Knowledge of trends and prospects for the development of the use of traditional and alternative energy sources, technologies to produce bioethanol, biodiesel, biogas.
How to use the acquired knowledge and skills (competences)	Ability to quantify comparative assessment of different types and sources of energy resources, systems of their use. Ability to build effective systems for the use of energy resources, determination of the capacity of the relevant electromechanical equipment.
Information support	Syllabus, textbook, textbooks, reference sources, methodological support (manuals) for practical classes
Form of classes	Lectures and practical classes
Semester control	Exam

Discipline	**Engineering and Technical Regulation in the Field of Hydrogen Production and Use***
VO Level	Second (Master's)
Course	1 year (2 semester)
Volume	according to the work plan
Language of instruction	English
Pulpit	Automation of electrotechnical and mechatronic complexes
Requirements to start studying	Transport Systems of Electromechanical Complexes, Energy and Resource Saving Installations, Thermodynamics and Heat Transfer, etc.
What will be studied	Legal framework for the development of hydrogen energy. Analysis of international best practices and plans for the use of hydrogen.
Why it's interesting/should be studied	The purpose of studying the discipline is the formation of students' theoretical knowledge and practical skills in the use of modern international practices and plans for the use of hydrogen technologies.
What you can learn (learning outcomes)	Know and understand the main provisions of regulatory and legislative documents that regulate innovation activities in Ukraine related to the development of hydrogen energy.
How to use the acquired knowledge and skills (competences)	Ability to demonstrate awareness and ability to use regulations, norms, rules and standards aimed at the development of hydrogen energy.
Information support	Syllabus, textbook, textbooks, reference sources, methodological support (manuals) for practical classes
Form of classes	Lectures and practical classes
Semester control	Exam