NATIONAL TECHNICAL UNIVERSITY OF UKRAINE "IGOR SIKORSKY KYIV POLYTECHNIC INSTITUTE"
FACULTY OF ELECTRIC POWER ENGINEERING AND AUTOMATICS
DEPARTMENT OF AUTOMATION OF ELECTROMECHANICAL SYSTEMS AND ELECTRIC DRIVE

APPROVED

Methodical Council of Igor Sikorsky Kyiv Polytechnic Institute

(protocol No. 5 dated February 29, 2024)

Departmental CATALOG

of elective academic disciplines of the professional training cycle of the educational and professional program " Electromechanical Automation Systems, Electric Drive and Electromobility " in specialty 141 - "Electric power engineering, electrical engineering and electromechanics" of the first (bachelor's) level of higher education

ADOPTED

Academic Council of the Faculty of Electric Power Engineering and Automatics of Igor Sikorsky Kyiv Polytechnic Institute

(protocol No. 6 dated January 29 , 2024)

Kyiv 2024

INTRODUCTION

In accordance with Section X of Article 62 of the Law of Ukraine "On Higher Education" (No. 1556-VII dated 01.07.2014), elective subjects are subjects of free choice of students for a certain level of higher education, aimed at ensuring general and special (professional) competences according to specialty. The amount of elective academic disciplines is at least 25% of the total number of ECTS credits provided for this level of education.

The procedure for choosing academic disciplines is implemented through the University's specialized information system. The catalog contains an annotated list of disciplines offered to students of the first (bachelor) level of higher education according to the curriculum for the next academic year:

- students of the 1st year - choose 3 disciplines for the second year of training (**1** for the third semester and **2** for the fourth semester);
- II year students – choose 5 disciplines for the third year of training (**3** for the fifth semester and **2** for the sixth semester);
- III-year students choose 6 disciplines for the fourth year of training (**3** for the seventh semester and **3** for the eighth semester).

For some disciplines, there is a limit on the number of students to whom it can be offered. In these cases, the number of students to whom the discipline can be offered is indicated separately.

In the event that it is impossible to form a study group for studying a certain discipline of the P-Catalog, students are given the opportunity to either make a second choice - by joining already formed study groups (second wave of selection), or to master the chosen discipline individually using a mixed form of study and individual consultations (the opportunity is provided upon a substantiated application of the student and the decision of the department that provides teaching of this discipline).

All aspects regarding the realization of students' right to choose disciplines can be found in the Regulations on the right to free choice of disciplines by applicants for higher education at the Igor Sikorsky Kyiv Polytechnic Institute.

Content

Disciplines for choice for the third semester

Elements of operational calculus and field theory

HE level	First (undergraduate)
Course	2
Amount	4 ECTS credits
Language of teaching	Ukrainian
Deparment	Mathematical physics and differential equations
Requirements for starting studies	Higher mathematics. Part 1,2: linear algebra and analytic geometry, differential and integral calculus of functions of one variable, differentiation of functions of many variables, differential equations, numerical and functional series.
What will be studied	Elements of operational calculus: concept of original and image, properties of Laplace transform, application of operational calculus; integration of functions of many variables: double, triple, curvilinear and surface integrals; elements of field theory -with general field characteristics, gradient of a scalar field, divergence, rotor, circulation and flow of a vector field. Potential field and its properties. Solenoidal and Laplace field.
Why is it interesting/should be studied?	Mastery of the academic discipline involves students' assimilation of the mathematical apparatus of classical methods of physical research, including electrical processes, electromagnetic processes in electrostatic, stationary and alternating electromagnetic fields.
What you can learn (learning outcomes)	To master the mathematical language used when describing physical processes and mathematical methods used for the purpose of researching these processes.
How to use acquired knowledge and skills (competencies)	Solve practical problems related to the operation of electrical systems and networks, high-voltage power lines, operation of electric machines, devices. For setting and solving problems of a theoretical and applied nature in the field of electrical engineering, power engineering, electronics, etc.
Information support	Syllabus, educational and methodological materials (lecture notes, presentations for lectures, workshops for practical classes)
The form of classes	Lectures, practical classes
Semester control	Test

Elements of the theory of functions of a complex variable

HE level	First (undergraduate)
Course	2
Amount	4 ECTS credits
Language of teaching	Ukrainian
Deparment	Mathematical physics and differential equations
Requirements for starting studies	Higher mathematics. Part 1,2: linear algebra and analytic geometry, differential and integral calculus of functions of one variable, differentiation of functions of many variables, differential equations, numerical and functional series.
What will be studied	Elements of the theory of functions of a complex variable: the concept of a function of a complex variable, its properties, the derivative and integral of a function of a complex variable, remainders of functions of a complex variable and their application . Laplace transform, its properties and applications: elements of operational calculus.
Why is it interesting/should be studied?	Mastery of the academic discipline involves students' assimilation of the mathematical apparatus of classical methods of research into physical, including electrical, processes, methods of research into electric circuits.
What you can learn (learning outcomes)	To master the mathematical language used when describing physical processes and mathematical methods used for the purpose of researching these processes.
How to use acquired knowledge and skills (competencies)	Solve practical problems related to the operation of electrical systems and networks, high-voltage power lines, operation of electric machines, devices. For setting and solving problems of a theoretical and applied nature in the field of electrical engineering, power engineering, electronics, etc.
Information support	Syllabus, educational and methodological materials (lecture notes, presentations for lectures, workshops for practical classes)
The form of classes	Lectures, practical classes
Semester control	Test

Special sections of higher mathematics

HE level	First (undergraduate)
Course	2
Amount	4 ECTS credits
Language of teaching	Ukrainian
Deparment	Mathematical physics and differential equations
Requirements for starting studies	Higher mathematics. Part 1,2: linear algebra and analytic geometry, differential and integral calculus of functions of one variable, differentiation of functions of many variables, differential equations, numerical and functional series.
What will be studied	Elements of the theory of mathematical physics equations (D'Alembert's formula and the Fourier method), elements of probability theory (random events and random variables) and mathematical statistics (sampling and hypothesis testing, confidence intervals).
Why is it interesting/should be studied?	Mastery of the academic discipline involves students' assimilation of the mathematical apparatus of classical methods of researching physical, including electrical, processes, methods of researching electric circuits using the example of long lines. Students also learn to apply the methods of probability theory and mathematical statistics to process the results of experiments.
What you can learn (learning outcomes)	To master the mathematical language used when describing physical processes and mathematical methods used for the purpose of researching these processes.
How to use acquired knowledge and skills (competencies)	Solve practical problems related to the operation of electrical systems and networks, high-voltage power lines, the operation of electric machines, devices. Apply methods of probability theory and mathematical statistics when processing research results. For setting and solving problems of a theoretical and applied nature in the field of electrical engineering, power engineering, electronics, etc.
Information support	Syllabus, educational and methodological materials (lecture notes, presentations for lectures, workshops for practical classes)
The form of classes	Lectures, practical classes
Semester control	Test

Disciplines for choice for the fourth semester

Industrial electronics

Department that provides teaching	FEA of theoretical electrical engineering
Possible restrictions	No restrictions
HE level	First (undergraduate)
Specialties for which the discipline is adapted	Specialty 141 – "Electric power engineering, electrical engineering and electromechanics"
Course	2 course
The scope of the discipline and the distribution of hours of classroom and independent work	4 ECTS credits/120 hours. Classroom classes: lectures - 36 hours, laboratory work. - 18 hours, independent work - 66 hours
Language of teaching	Ukrainian
Requirements for starting the study of the discipline	Knowledge obtained from the study of courses: higher mathematics - sections: matrix algebra, differential equations, theory of functions of a complex variable, Fourier and Laplace transformations, numerical methods of solving algebraic and differential equations; of general physics - sections: electricity; theoretical foundations of electrical engineering - sections: direct and alternating current circuits, three-phase circuits, transient processes.
What will be studied	Physical foundations of semiconductor electronics. Principles of operation of the main types of semiconductor devices, features of analog, pulse devices for amplification, generation and processing of signals in electronic control and information display systems, as well as sources of secondary power supply.
Why it is interesting / should be studied	Nowadays, progress in almost all fields of science and technology is due to advances in electronics (especially microelectronics) and its use in these fields. Therefore, the knowledge of industrial electronics is necessary for an engineer of any profession, and especially from the profession of power engineering, electrical engineering, and electromechanics.
What you can learn	Understand the principles of operation of the main types of semiconductor devices and the construction and operation based on them of the circuits of analog and pulse devices, sources of secondary power supply, methods of analysis of electronic devices; To acquire the skills of conducting experimental studies of electronic circuits, drawing up reports and making general conclusions, using radio measuring equipment.
How to use acquired knowledge and skills	The knowledge gained during the study of the discipline "Industrial Electronics" is used in solving practical problems in the field of power conversion technology, microprocessors and digital electronics, automatic control systems of technological complexes, as well as directly in engineering practice.
Information support of the discipline	Syllabus, lecture notes, manual for laboratory work, distance course on the distance learning platform "Sikorsky" https://do.ipo.kpi.ua/course/view.php?ID=3860
Semester control	Test

Fundamentals of electronics in electrical engineering

Department that provides teaching	FEA of theoretical electrical engineering
Possible restrictions	No restrictions
HE level	First (undergraduate)
Specialties for which the discipline is adapted	Specialty 141 – "Electric power engineering, electrical engineering and electromechanics"
Course	2 course
The scope of the discipline and the distribution of hours of classroom and independent work	4 ECTS credits Classroom classes: lectures – 36 hours, laboratory – 18 hours, independent work – 66 hours
Language of teaching	Ukrainian
Requirements for starting the study of the discipline	The study of the discipline is based on the knowledge obtained from the courses: higher mathematics - sections: matrix algebra, differential equations, theory of functions of a complex variable, numerical methods of solving algebraic and differential equations; of general physics - sections: electricity; theoretical foundations of electrical engineering - sections: direct and alternating current circuits, three-phase circuits, transient processes.
What will be studied	Principles of operation of the main types of semiconductor devices, features of analog, pulse devices for amplification, generation and processing of signals in electronic control systems in electrical engineering.
Why it is interesting / should be studied	The knowledge gained during the study of the discipline "Fundamentals of Electronics in Electric Power" allows you to speed up the solution of practical problems in the field of power conversion technology, microprocessors and digital electronics, automatic control systems of technological complexes, as well as directly in engineering practice.
What you can learn	As a result of studying the discipline "Fundamentals of Electronics in Electric Power", students acquire: a) knowledge of the physical foundations of semiconductor devices; principles of construction and operation of circuits of analog devices; methods of analysis of electronic devices; b) the ability to use reference literature and draw electronic circuits in accordance with current state standards; c) skills of conducting experimental studies of electronic circuits, drawing up reports and drawing general conclusions; use of radio measuring equipment; independent work with educational, methodical and reference literature.
How to use acquired knowledge and skills	The knowledge and skills acquired during the course "Fundamentals of Electronics in Power Engineering" are used to solve special problems on the basics of microprocessor technology, power conversion technology, and computer automation tools in power generation.
Information support of the discipline	Syllabus, lecture notes, manual for laboratory work, distance course on the distance learning platform "Sikorsky" https://do.ipo.kpi.ua/course/view.php?ID=6386
Semester control	Test

Electronics in electrical installations

Department that provides teaching	FEA of theoretical electrical engineering
Possible restrictions	No restrictions
HE level	First (undergraduate)
Specialties for which the discipline is adapted	Specialty 141 – "Electric power engineering, electrical engineering and electromechanics"
Course	2 course
The scope of the discipline and the distribution of hours of classroom and independent work	4 ECTS credits Classroom classes: lectures – 36 hours, laboratory – 18 hours, independent work – 66 hours
Language of teaching	Ukrainian
Requirements for starting the study of the discipline	Knowledge obtained from studying higher mathematics courses - sections: matrix algebra, differential equations, theory of functions of a complex variable, Fourier and Laplace transformations, numerical methods of solving algebraic and differential equations; of general physics - sections: electricity; theoretical foundations of electrical engineering - sections: circuits of direct and alternating currents, transient processes.
What will be studied	Directions of electronics development; operating principles and characteristics of semiconductor devices; basic electronic devices of analog circuitry: amplifiers with capacitive and transformer connections, DC amplifiers, differential amplifiers, operational amplifiers.
Why it is interesting / should be studied	Nowadays, progress in almost all fields of science and technology is due to advances in electronics and its use in these fields. Therefore, knowledge is necessary for an engineer in the field of electrical power, electrical engineering. Wide use of electronics in electrical installations is due to the following properties of electronic devices: high sensitivity; high speed of electronic devices; universality, the essence of which is that other types of energy: mechanical, thermal, acoustic, atomic, etc., are relatively easily converted into electrical energy, which is the basis for the operation of all types of electronic devices; the possibility of miniaturization of electronic devices.
What you can learn	As a result of studying the "Electronics in electrical installations " module , students acquire: a) knowledge of the principles of operation of the main types of semiconductor devices; principles of construction and operation of circuits of analog devices; methods of analysis of electronic and microelectronic devices; b) the ability to use reference literature and draw electronic circuits in accordance with current state standards; c) skills of conducting experimental studies of electronic circuits, drawing up reports and drawing general conclusions; use of radio measuring equipment.
How to use acquired knowledge and skills	The knowledge and skills acquired during the study of the course "Electronics in electrical installations" are used in solving special issues related to the operation of microprocessor equipment, power conversion equipment, computer automation tools in electrical installations of electrotechnological complexes and systems.
Information support of the discipline	Syllabus, lecture notes, manual for laboratory work, distance course on the distance learning platform "Sikorsky" https://do.ipo.kpi.ua/course/view.php?ID=6387
Semester control	Test

Theory of nonlinear circles and circles with distributed parameters

Department that provides teaching	FEA of theoretical electrical engineering
Possible restrictions	No restrictions
HE level	First (undergraduate)
Specialties for which the discipline is adapted	Specialty 141 – "Electric power engineering, electrical engineering and electromechanics"
Course	2 course
The scope of the discipline and the distribution of hours of classroom and independent work	4 ECTS credits Classroom classes: lectures - 36 hours, practical - 18 hours, laboratory - 18 hours, independent work - 48 hours
Language of teaching	Ukrainian
Requirements for starting the study of the discipline	Theoretical foundations of electrical engineering - 1,2: methods of analysis of DC and sinusoidal current circuits; Physics - sections of electricity and magnetism
What will be studied	Fixed processes in circles with distributed parameters on the example of a long line - coordinated mode of operation of the line, non-coordinated modes of the line with losses and without losses; modes of operation of the line with different nature of the load; transient processes in circles with distributed parameters - calculation of reflected and refracted waves, general method of calculating transient processes in lines of finite length; established processes in non-linear electric circuits of direct current; established processes in non-linear magnetic circuits of direct and alternating currents; transient processes in non-linear circuits.
Why it is interesting / should be studied	Knowledge of methods for calculating stable and transient modes of operation of nonlinear circuits and circuits with distributed parameters is necessary for determining the operating and emergency modes at the stage of design, testing, and operation of electrical equipment.
What you can learn	Analyze different modes of operation of long lines, high and ultra-high frequency circuits - idle, short circuit, active, inductive, capacitive load; to analyze the influence of nonlinear elements on the value and shape of voltage and current curves in electric and magnetic circuits, to determine the optimal method of calculating a nonlinear circuit, to analyze a nonlinear magnetic circuit of alternating current using a vector diagram.
How to use acquired knowledge and skills	Solve practical problems related to the generation of electrical energy, the operation of electrical systems and networks, high-voltage power lines, the operation of electric machines, devices, and electric drives.
Information support of the discipline	Syllabus, lecture notes, manual for laboratory work, manual for practical classes, distance course on the distance learning platform "Sikorsky"
Semester control	Test

Fundamentals of electromagnetic field theory

Department that provides teaching	FEA of theoretical electrical engineering
Possible restrictions	No restrictions
HE level	First (undergraduate)
Specialties for which the discipline is adapted	Specialty 141 – "Electric power engineering, electrical engineering and electromechanics"
Course	2 course
The scope of the discipline and the distribution of hours of classroom and independent work	4 ECTS credits Classroom classes: lectures - 36 hours, practical - 18 hours, laboratory work - 18 hours, independent work - 48 hours.
Language of teaching	Ukrainian
Requirements for starting the study of the discipline	Theoretical foundations of electrical engineering. Part 1, Part 2: methods of analysis of DC and sinusoidal current circuits; Physics - sections of electricity and magnetism
What will be studied	General characteristics of the electromagnetic field, a complete system of equations of the electromagnetic field. The vortex - free nature of the electrostatic field. Electric potential gradient. Determination of the potential according to the given distribution of charges. Poisson's and Laplace's equations. Boundary conditions on the surface of conductors, on the surface of separation of two dielectrics. The equation of the electric field of currents. Electric field near direct current conductors. Electric field of currents in a conductor. Boundary conditions on the separation surface of two conducting media. Scalar and vector magnetic potentials. The general task of calculating the magnetic field. Boundary conditions on the surface of separation of two media with different magnetic permeabilities. Characteristics of an alternating electromagnetic field. System of basic equations and material equations. A variable electromagnetic field in a dielectric. Dalembert's equation, the general solution of the equation. A plane electromagnetic wave in a dielectric, the speed of wave propagation. The energy of the electromagnetic field, the Umov-Poynting theorem.
Why it is interesting / should be studied	Knowledge of the basics of field theory will allow you to determine the limits of the use of its laws and the laws of the theory of circles, quantitatively describe electromagnetic processes in various devices, as well as determine the features of field energy transfer. Knowledge of the methods of calculating electromagnetic fields is necessary for the design, testing, operation of electrotechnological installations and for the implementation of technologies in various fields.
What you can learn	Feel free to navigate in the basic principles of electromagnetic field theory; to analyze the electromagnetic field of an electric machine, the features of electromagnetic field energy transfer, to determine the basic essence of physical phenomena and the limits of using the laws of the electromagnetic field in their practical application.
How to use acquired knowledge and skills	The knowledge obtained during the study of the discipline is used in solving practical problems related to and with the operation of electrical systems and networks , high-voltage power lines, the operation of electric machines, devices , electric drives. To set and solve problems of a theoretical and applied nature in the field of electrical engineering, power engineering, electronics, etc., it is necessary to use the methods of electromagnetic field theory.
Information support of the discipline	Syllabus, lecture notes, manual for laboratory work, manual for practical classes, distance course on the distance learning platform "Sikorsky"
Semester control	Test

Physical foundations of electrical engineering

Department that provides teaching	FEA of theoretical electrical engineering
Possible restrictions	No restrictions
HE level	First (undergraduate)
Specialties for which the discipline is adapted	Specialty 141 – "Electric power engineering, electrical engineering and electromechanics"
Course	2 course
The scope of the discipline and the distribution of hours of classroom and independent work	4 ECTS credits Classroom classes: lectures - 36 hours, practical - 18 hours, laboratory - 18 hours, independent work - 48 hours
Language of teaching	Ukrainian
Requirements for starting the study of the discipline	Theoretical foundations of electrical engineering. Part 1, Part 2: methods of analysis of DC and sinusoidal current circuits; Physics - sections of electricity and magnetism
What will be studied	The basic concepts of electrodynamics from the point of view of the classical theory of the electromagnetic field. Maxwell's system of equations . Electrostatic field . Electric and magnetic field of direct currents. The equation of an alternating electromagnetic field . Energy balance in the electromagnetic field , in electrical systems and in the electrical circuit. Problems of higher harmonics in modern power supply systems . Modern theories of instantaneous power. Basics of generalized electrodynamics . Mathematical foundations, postulates and conclusions of the special theory of relativity.
Why it is interesting / should be studied	Knowing the basics of field theory will allow you to determine the limits of using its laws and the laws of circle theory, quantitatively describe electromagnetic processes in various devices, as well as determine the features of field energy transfer in electrotechnical systems and devices. Also, knowledge of problems in power supply systems will allow to identify them in time and choose an effective method for suppressing higher current and voltage harmonics .
What you can learn	Feel free to navigate in the basic principles of electromagnetic field theory; analyze the features of electromagnetic field energy transfer, to determine the basic essence of physical phenomena and the limits of using the laws of the electromagnetic field in their practical application. Choose an effective method of suppressing higher harmonic components of currents and voltages in power supply systems, apply in practice the generalized law of conservation of energy of the electromagnetic field .
How to use acquired knowledge and skills	The knowledge obtained during the study of the discipline is used in solving practical problems related to and with the operation of electrical systems and networks , high-voltage power lines, the operation of electric machines, devices , electric drives. To set and solve problems of a theoretical and applied nature in the field of electrical engineering, power engineering, electronics, etc., it is necessary to use the methods of the theory of the electromagnetic field, the theory of instantaneous power, and the special theory of relativity.
Information support of the discipline	Syllabus, lecture notes, manual for laboratory work, manual for practical classes, distance course on the distance learning platform "Sikorsky"
Semester control	Test

Disciplines to choose for the fifth semester

Fundamentals of microprocessor technnics

Department that provides teaching	Automation of electromechanical systems and electric drive
Possible restrictions	No restrictions
HE level	First (undergraduate)
Specialties for which the discipline is adapted	141 "Electric power engineering, electrical engineering and electromechanics"
Course	3
The scope of the discipline and the distribution of hours of classroom and independent work	4 ECTS credits classroom classes: lectures – 36 hours, laboratory work – 36 hours independent work - 48 hours
Language of teaching	Ukrainian
Requirements for starting the study of the discipline	Basic knowledge of electrical engineering, electronics, circuitry and programming languages
What will be studied	The discipline studies: the architecture of modern microprocessor systems and microcontrollers; modern methods and means of developing microcontroller software using C/C++ programming languages; peculiarities of the development of structures and software of microcontroller devices for controlling various equipment. In laboratory sessions, students will be able to develop software for NUC 140 series microcontrollers in the Keil environment uVision and explore their operation using debug boards.
Why is it interesting/should be studied?	Today, microcontrollers and microcomputers are used for information processing, monitoring and control of a wide variety of equipment in almost all areas of human life. These devices are the core of programmable logic controllers and embedded control devices used in electromechanical systems. Therefore, acquiring knowledge and skills regarding their development, programming and operation is important for specialists in electrical engineering and electromechanics.
What you can learn	– develop device structures for monitoring and controlling various equipment based on modern microcontrollers and microcomputers; – develop algorithms and compile programs for microcontrollers in the C and C++ programming languages and debug them in the Keil programming environment uVision .
How to use acquired knowledge and skills	The acquired knowledge and skills will allow solving a full cycle of problems in the creation and use of microcontroller devices for controlling equipment, namely: determine the requirements for these devices; develop their structure and choose schematic solutions; to develop a work algorithm and create programs for managing them.
Information support of the discipline	Syllabus, lecture notes, methodological instructions for laboratory work. 1. Podzharenko V.O., Kucheruk V.Yu., Sevastyanov V.M. Fundamentals of microprocessor technology. Study guide. - Vinnytsia: VNTU, 2006. - 226 p.
Semester control	Test

Simulation of automatic control systems

Department that provides teaching	Automation of electromechanical systems and electric drive
Possible restrictions	No restrictions
HE level	First (undergraduate)
Specialties for which the discipline is adapted	141 "Electric power engineering, electrical engineering and electromechanics"
Course	3
Amount and distribution of hours of classroom and independent work	4 ECTS credits classroom classes: lectures – 36 hours, laboratory work – 36 hours independent work - 48 hours
Language of teaching	Ukrainian
Requirements for starting studies	Knowledge of mathematics (linear algebra, derivatives, integrals, differential equations), knowledge of the basics of programming, mathematical methods in electrical engineering (numerical integration, methods of solving differential equations, approximation, interpolation), theories of automatic control (methods of mathematical description of dynamic systems and the connection between them, the analysis of linear dynamic systems in the space of time, according to the location of zero-poles, frequency analysis, Laplace transformations, equivalent transformations of structural diagrams).
What will be studied	The subject of studying the discipline is to acquire the skills of structural mathematical and virtual modeling of automatic control systems of electromechanical objects in the environment of the Simulink program of the MATLAB package using SimPowerSystem library blocks , as well as familiarity with the main functions of analysis and synthesis of control systems. Laboratory work is carried out in the form of a computer workshop in the environment of the MATLAB package . In laboratory classes, students are given the opportunity to consult and perform some tasks that require the use of mathematical modeling in the disciplines "Nonlinear and discrete automatic control systems", "Electric drive theory", "Robotics and mechatronics", etc.
Why is it interesting/should be studied?	The study of this discipline will help students to significantly reduce the time of performing many computational and graphic, laboratory and course works and practical tasks in such disciplines as "Modeling of electromechanical systems", "Electric drive control systems", "Digital signal processing", "Optimal and intelligent control systems" . Every student must have a section on the study of the electric drive system by the method of mathematical modeling in his bachelor's and master's theses.
What you can learn	As a result of the training, students will be able to develop a mathematical description of electric and electromagnetic linear and non-linear circuits, direct and alternating current electric motors, mechanical parts of the electric drive, taking into account elasticity and other features of kinematic transmissions, and develop structural diagrams and Simulink models based on it. If the mathematical description of the researched objects is too complex, students will be able to develop their virtual physical models using library blocks of the SimPowerSystem application that simulate the physical connection of individual electrical, electronic, and electromechanical devices.
How to use acquired knowledge and skills	The acquired knowledge can be used in the calculation of stable and transient processes in electrical circuits, in mechanical and electromechanical systems; in the analysis and synthesis of automatic control systems; when studying objects with non-linear static characteristics given in the form of tables, when solving problems of optimal control.
Information support	Syllabus, study guide (electronic edition), methodological instructions for performing laboratory work, recommended literature, demonstrations of the MATLAB programming system .
Semester control	Test

Digital control of electromechanical systems

Department that provides teaching	Automation of electromechanical systems and electric drive
Possible restrictions	No restrictions
HE level	First (undergraduate)
Specialties for which the discipline is adapted	141 "Electric power engineering, electrical engineering and electromechanics"
Course	3
The scope of the discipline and the distribution of hours of classroom and independent work	4 ECTS credits classroom classes: lectures – 36 hours, laboratory work – 36 hours independent work - 48 hours
Language of teaching	Ukrainian
Requirements for starting the study of the discipline	Knowledge of higher mathematics (linear algebra, differential and integral calculus, operations), theory of automatic control, mathematical methods in electromechanics, modeling and analysis of automatic control systems, control of electric drives
What will be studied	The discipline studies the peculiarities of digital automatic control systems, their mathematical description in the form of differential equations, discrete transfer functions and in the space of states; frequency analysis and stability criteria; methods of discrete approximation of continuous dynamic objects; methods of synthesis of digital-analog systems of automatic control of linear continuous electromechanical objects based on their analog prototypes.
Why is it interesting/should be studied?	Currently, the lion's share of modern electric drives of direct and alternating current are performed with digital control, which is carried out with the help of microprocessors, control computers, microcontrollers, digital signal processors, etc. Successful use of these devices is impossible without deep mastery of the methods of analysis and synthesis of digital systems.
What you can learn	– perform a mathematical description of digital control devices in the form of differential equations, which is necessary for programming microprocessors; – make discrete structural diagrams of digital systems, which is necessary for mathematical modeling of digital automatic control systems; – develop simulation programs for the study of digital systems, taking into account the effects of time quantization, delay and extrapolation; – to discretize the mathematical description of continuous dynamic systems; – determine the stability of digital systems; – choose the quantization period correctly.
How to use acquired knowledge and skills	The knowledge and skills acquired during the study of this discipline can be used when modeling digital electric drive systems, during the synthesis of digital regulators, setting and filtering devices, when programming microprocessors.
Information support of the discipline	Syllabus, textbook, manual for laboratory works.
Semester control	Test

Elements and devices of electromechanical systems and electric drives

Department that provides teaching	Automation of electromechanical systems and FEA electric drive
Possible restrictions	No restrictions
HE level	First (undergraduate)
The specialty for which the discipline is adapted	141 – Power engineering, electrical engineering and electromechanics
Course	3
Scope of discipline and distribution classroom hours and independent work	4 ECTS credits classroom classes: lectures – 54 hours, laboratory – 18 hours independent work - 48 hours
Language of teaching	Ukrainian
Requirements for starting studies	General knowledge of physics, theoretical foundations of electrical engineering of electric machines, electric drive, theory of automatic control.
What will be studied	The subject of study of the discipline "Elements and devices of electromechanical systems and electric drives" is the principles of operation, features of the design and functioning of electrical devices and elements of electromechanical systems. The course includes the study of basic electrical devices used in electromechanical systems, such as circuit breakers, fuses, contactors, relays, surge protection and lightning protection, contactor circuits for starting electric motors, protection relays. Students also study the principle of operation and features of the use of modern sensors of electrical and non-electrical quantities. A separate issue is devoted to modern regulators and analog components used in electric drives. Also, students get acquainted with the main principles of choosing electrical devices for the protection of electrical installations and sensors for the implementation of automatic control systems of electromechanical systems. Physical phenomena are also studied, which are the basis of the operation of electrical devices and sensors of various types.
Why is it interesting/should be studied?	The study of electrical devices and elements of electromechanical systems is crucial for the design of such systems, and also allows the student to freely navigate the wide variety of protection devices, switching devices, as well as sensors and regulators in the modern electrotechnical market.
What you can learn (learning outcomes)	– Know the principles of operation of electrical devices, – Know the principles of operation of sensors of electrical and non-electrical quantities and regulators – Choose electrical devices and sensors according to the given requirements for electromechanical systems – To optimize and improve the protection of the existing electrical schemes of electric drives using a modern element base and electrical devices.
How to use acquired knowledge and skills (competencies)	The acquired knowledge will help the future engineer freely choose devices and elements for integration into electromechanical systems, and will also be useful when designing new electromechanical systems using modern equipment
Information provision	Syllabus, lecture notes, lab guide, distance learning and other courses in Google Classroom
Semester control	Test

Software implementation of automatic control tasks

Department that provides teaching	Automation of electromechanical systems and electric drive
Possible restrictions	No restrictions
HE level	First (undergraduate)
Specialties for which the discipline is adapted	141 "Electric power engineering, electrical engineering and electromechanics"
Course	3
The scope of the discipline and the distribution of hours of classroom and independent work	4 ECTS credits classroom classes: lectures – 36 hours, computer workshops – 36 hours independent work - 48 hours
Language of teaching	Ukrainian
Requirements for starting the study of the discipline	Basic knowledge of higher mathematics, theory of automatic control, computing and programming languages
What will be studied	The subject studies: the basic syntax of the C++ language, the basics of procedural and object-oriented programming in the C++ language, the use of standard libraries for developing programs for Windows , numerical methods for solving automatic control problems and their algorithmic and software implementation on C++ language. At computer workshops, students in the Visual Studio environment in the C++ programming language will create console programs and programs for Windows , will develop programs for solving automatic management problems.
Why is it interesting/should be studied?	The use of the C++ programming language today allows you to create the most effective, from the point of view of speed, software applications. Therefore, it is used to develop system software for personal computers, software for embedded systems, microcomputers, and other devices. In addition, software for systems that must work in "real" time is also developed using this language. Recently, in electromechanical systems, complex control algorithms, based on the methods of the theory of automatic control, which require the solution of a number of problems in real time, are becoming widespread. Therefore, students' acquisition of knowledge and skills of software implementation of automatic control tasks in the C++ language will allow them to significantly improve their qualifications as specialists in electromechanics.
What you can learn	– create software applications in the Visual environment Studio in the C++ programming language using procedural and object-oriented approaches; – develop algorithms for solving automatic control problems using numerical methods and compile programs for their implementation.
How to use acquired knowledge and skills	The acquired knowledge and skills will allow to increase the professional level of future specialists, both in the field of development and operation of automatic control devices, and in related areas related to the development of application programs, including for processing experimental data, modeling processes in automatic control systems and other areas.
Information support of the discipline	Syllabus, lecture notes, methodological instructions for computer workshops. 1. C++ programming lessons. Access mode: https://acode.com.ua/uroki-po-cpp/ 2. D. D. Tatarchuk, Yu. V. Didenko. Programming in C and C++ languages: teaching. manual / D.D. Tatarchuk, Yu.V. Dadenko - K.: , 2012. - 112 p.
Semester control	Test

Python programming workshop

Department that provides teaching	Automation of electromechanical systems and electric drive
Possible restrictions	No restrictions
HE level	First (undergraduate)
Specialties for which the discipline is adapted	141 "Electric power engineering, electrical engineering and electromechanics"
Course	3
The scope of the discipline and the distribution of hours of classroom and independent work	4 ECTS credits classroom classes: lectures – 36 hours, computer workshops – 36 hours independent work - 48 hours
Language of teaching	Ukrainian
Requirements for starting the study of the discipline	Basic knowledge of higher mathematics, computing and programming languages
What will be studied	The subject studies: the basic syntax of the Python language , the basics of procedural, structural, object-oriented and functional programming in the Python language , the use of libraries for the development of programs for various purposes, including mathematical calculations and graphing, working with web applications and databases, data analysis and others. At computer workshops, students in the Jupiter Notebook environment (Anaconda 3) in the Python programming language will create programs for various purposes, which will allow you to familiarize yourself with the capabilities of this programming language.
Why is it interesting/should be studied?	Currently, the Python programming language is perhaps the easiest to learn, but due to a number of advantages, such as efficiency and cross-platform, it is used for: data analysis, data visualization, machine learning, software development, web application development, scripting and other tasks. A separate advantage of this programming language is a large number of open libraries, which allow you to significantly increase the speed of creating relationships. Therefore, students' acquisition of knowledge and skills in the use of the Python programming language will significantly improve their qualifications as specialists in electromechanics and automation.
What you can learn	– gain knowledge about the basic syntax of the Python language ; – create software applications in the Jupiter Notebook environment (Anaconda 3) in the Python programming language ; – develop using specialized libraries.
How to use acquired knowledge and skills	The acquired knowledge and skills will allow to increase the professional level of future specialists in electromechanics and automation, both in the field of development and operation of automatic control devices, and in related areas related to the development of application programs, including for processing data of experiments, modeling processes in automatic control systems and other areas.
Information support of the discipline	Syllabus, lecture notes, methodological instructions for computer workshops. 1. A.V. Yakovenko Fundamentals of programming . Python . Part 1. - Kyiv: KPI named after Igor Sikorskyi, 2018. – 195 p. 2. A tutorial on Python. Access mode: https://docs.python.org/uk/3/tutorial/index.html
Semester control	Test

Disciplines to choose for the fifth semester

Workshop on automation of technological processes

Department that provides teaching	Automation of electromechanical systems and electric drive
Possible restrictions	No restrictions
HE level	First (undergraduate)
Specialties for which the discipline is adapted	141 "Electric power engineering, electrical engineering and electromechanics"
Course	3
The scope of the discipline and the distribution of hours of classroom and independent work	4 ECTS credits/120 hours (lectures – 18 hours; practical classes – 18 hours; laboratory work – 18 hours).
Language of teaching	Ukrainian
Requirements for starting the study of the discipline	The educational component requires prior study of the educational components "Synthesis of logic schemes", "Automation systems-1", "Automation systems-2". In order to successfully master the material, the applicant is also recommended to have an average score of ***at least 85 from the educational components listed above.***
What will be studied	**The educational component aims to teach applicants:** - perform an analysis of the operating conditions of technological process automation schemes; - apply advanced synthesis methods to build control schemes for various technological processes; - work with advanced functionality of DE 10- Lite and DE 1- SoC developer boards based on programmable logic integrated circuits (FPICs) of the Cyclone family V and MAX 10; - in-depth programming of FPGAs in the Verilog language HDL ; - to compile control programs for the automation of technological processes in IL and LD languages for programmable logic controllers and test them on laboratory installations; - to design basic electrical diagrams and connection diagrams for developed control schemes of technological processes; **It will be possible to consolidate the acquired knowledge and skills during the implementation of RGR on the design of an individual system of technological process automation.**
Why is it interesting/should be studied?	Automation of technological processes within the framework of Industry 4.0 technologies is rapidly developing all over the world. Powerful logic controllers and programmable logic integrated circuits have already flooded industry and are widely used for its automation. No industrial facility can do without a logic controller, and programmable logic integrated circuits and processors based on them are widely implemented in electric transport. In the framework of global digitalization, knowledge of the principles of design, synthesis, development and programming of technological process automation systems is very relevant and requires constant attention.
What you can learn	**After studying the educational component, applicants can achieve the following learning outcomes:** apply application software, microcontrollers and microprocessor technology to solve practical problems in professional activities; choose and apply suitable methods for the analysis and synthesis of electromechanical and electric power systems with specified indicators; know and understand the principles of operation of integrated microcircuits, programmable logic controllers and programmable logic integrated circuits; to be able to apply the laws of algebra-logic, code conversion, Carnot maps, the basis of transition tables, graph transitions, cyclograms and multiplexers-selectors for the synthesis of logic control schemes for automation systems; to be able to apply the methods of synthesis of discrete automation circuits to compile programs for programmable logic relays and programmable logic integrated circuits, to select equipment when designing discrete automation systems, to compile logic circuits on microcircuits using a modern element base; develop design and construction documentation for control schemes of electromechanical systems; program microprocessors, microcontrollers, programmable logic integrated circuits and logic controllers and use them to implement algorithms for controlling electric drives.
How to use acquired	The knowledge and skills obtained as a result of studying the educational component

knowledge and skills	can be used in the design, research and modernization of industrial automation systems of technological processes based on programmable logic integrated circuits and programmable logic controllers. The combination of skills to develop and program complex control systems of technological processes using a diverse element base will allow the future engineer to work with many technological objects of industry, transport, etc.
Information support of the discipline	Basic literature: *1. Avrunin O.G. "Fundamentals of the VHDL language for designing digital devices on FPGAs": teaching. manual / O.G. Avrunin, T.V. Nosova, V.V. Semenets Kharkiv: Khnure, 2018. 196 p.* *2. Design of computer systems based on microcircuits of programmable logic [Text]: monograph / S.A. Ivanets, Yu.O. Zuban, V.V. Kazimir, V.V. Litvinov. – Sumy: Sumy State University, 2013. – 313 p.*
Semester control	Test

Design of electromechanical systems

Department that provides teaching	Automation of electromechanical systems and electric drive
Possible restrictions	No restrictions
HE level	First (undergraduate)
Specialties for which the discipline is adapted	141 "Electric power engineering, electrical engineering and electromechanics"
Course	3
The scope of the discipline and the distribution of hours of classroom and independent work	4 ECTS credits classroom classes: lectures - 18 hours, practical work - 36 hours, laboratory work - 18 hours independent work - 48 hours
Language of teaching	Ukrainian
Requirements for starting the study of the discipline	Knowledge of disciplines: elements and devices of electromechanical systems and electric drive, theoretical foundations of electrical engineering, electric drive, industrial electronics, automation systems.
What will be studied	The subject of study of the discipline is: • project development rules in accordance with the requirements of regulatory and technical, design and technological documentation; • system-oriented program packages as means of creating project documentation
Why is it interesting/should be studied?	Drawing up project documentation is a necessary stage in the development of electromechanical systems, since their further practical implementation is based on it. Systemic knowledge of project creation allows: • minimize the time of its development; • to analyze the project documentation provided for review; • compete in the labor market.
What you can learn (learning outcomes)	Knowledge: • basic standards for the development of design documentation; • principles and sequence of stages of project creation; • scheme implementation rules; • completeness of documents for the project. Skill: • develop a technical task for the project; • use regulatory and technical documentation when developing projects of electromechanical systems; • analyze the market, conduct a search for the necessary components for the implementation of electromechanical systems and carry out an economic justification of the project; • apply modern applied system-oriented program packages for effective design; • practical skills of installing electrical equipment.
How to use acquired knowledge and skills (competencies)	The acquired skills in the development and execution of design and construction documentation are used during the implementation of the diploma project of the educational and qualification level of a bachelor and a master's thesis. Competence in the field of designing electromechanical systems is one of the most important criteria for employment at electromechanical and electrotechnical enterprises engaged in commercial design
Information support	Syllabus, methodical instructions for RGR, methodical instructions for practical classes and laboratory works, lecture notes (printed and electronic edition).
The form of classes	Syllabus, lecture notes, manual for laboratory works, manual for practical classes.
Semester control	Test

Digital signal processing in electromechanical systems

Department that provides teaching	Automation of electromechanical systems and electric drive
Possible restrictions	No restrictions
HE level	First (undergraduate)
Specialties for which the discipline is adapted	141 "Electric power engineering, electrical engineering and electromechanics"
Course	3
The scope of the discipline and the distribution of hours of classroom and independent work	4 ECTS credits classroom classes: lectures – 36 hours, laboratory work – 18 hours independent work - 66 hours
Language of teaching	Ukrainian
Requirements for starting the study of the discipline	Knowledge of control of electric drives, theory of automatic control, electric machines, theoretical foundations of electrical engineering
What will be studied	The discipline studies the peculiarities of digital signal processing that exist in modern electromechanical systems and power electronics. This includes processes of digital-analog conversion in devices with pulse-width modulation, formation of pulse-width modulation by means of modern digital signal processors, processing of signals from sensors of mechanical coordinates (torque, speed, angular position). Classic issues of digital signal processing, such as correlation, convolution, fast Fourier transform, signal filtering, are briefly considered.
Why is it interesting/should be studied?	Modern control systems of various technological objects, as a rule, are implemented on digital signal processors and require the use of real-time signal processing methods. Therefore, for their development and effective practical use, it is necessary to know and understand the methods of digital signal processing, including those specific to electromechanical systems.
What you can learn	– effectively process analog signals from sensors of electrical quantities in systems with pulse width modulation; – form pulse-width modulation by means of digital signal processors; – process signals from sensors of mechanical coordinates of various types; – understand classic methods of digital signal processing;
How to use acquired knowledge and skills	To develop modern digital control systems for technological objects of various purposes.
Information support of the discipline	Syllabus, lecture notes, manual for laboratory works.
Semester control	Test

Mechatronics

Department that provides teaching	Automation of electromechanical systems and FEA electric drive
Possible restrictions	No restrictions
HE level	First (undergraduate)
The specialty for which the discipline is adapted	141 – Power engineering, electrical engineering and electromechanics
Course	3
Scope of discipline and distribution classroom hours and independent work	4 ECTS credits classroom classes: lectures – 36 hours, practical – 18 hours independent work - 66 hours
Language of teaching	Ukrainian
Requirements for starting studies	General knowledge of physics, theoretical foundations of electrical engineering of electric machines, electric drive, theory of automatic control.
What will be studied	The subject of study of the discipline " Mechatronics " is the processes of electromechanical conversion of energy in electric machines, which are used as drives in modern electric drives. The course includes the study of basic mathematical models of asynchronous and synchronous motors, direct current motors and stepper motors, which are widely used in modern electromechanical systems. Also, students study the principle of operation and features of various types of engines from the point of view of their integration into automatic control systems, for the further creation of control algorithms for such engines. Students also study the peculiarities of applying mathematical apparatus to the analysis of processes of electromechanical energy conversion in electric motors. The course focuses on frequency control of asynchronous motors and torque control of synchronous motors, issues of technical implementation of control algorithms are studied, and students acquire practical skills in researching the processes of electromechanical energy conversion through mathematical modeling.
Why is it interesting/should be studied?	Studying the processes of electromechanical energy conversion as well as the mathematical apparatus that describes these processes is extremely important for an engineer in the further creation of new energy-efficient engine control algorithms.
What you can learn (learning outcomes)	– Know the principles of electromechanical energy conversion in electric motors of various types, – Know the principles of controlling the moment, speed and position of electric drives of various types. – Choose mathematical models for further analysis of processes in electric motors by means of mathematical modeling – Analyze electromechanical systems from the point of view of ensuring the quality of control of mechanical parameters by controlling the electrical parameters of motors.
How to use acquired knowledge and skills (competencies)	The knowledge gained will help the future engineer in creating new energy-efficient algorithms for controlling electric drives. It will provide an understanding of the relationships between mechanical and electrical parameters of individual types of electric motors.
Information provision	Basics of mechatronics [Electronic resource]: study guide for students of specialty 141 "Electric power, electrical engineering and electromechanics" / KPI named after Igor Sikorskyi; edited by: S. M. Peresada, M. V. Pushkar. – Electronic text data (1 file: 1.87 MB). – Kyiv: KPI named after Igor Sikorskyi, 2020. – 137 p. https://ela.kpi.ua/handle/123456789/32203 Syllabus, distance and next course in Google Classroom
Semester control	Test

Modern CAD packages of electromechanical systems

Department that provides teaching	Automation of electromechanical systems and electric drive
Possible restrictions	No restrictions
HE level	First (undergraduate)
Specialties for which the discipline is adapted	141 "Electric power engineering, electrical engineering and electromechanics"
Course	3
The scope of the discipline and the distribution of hours of classroom and independent work	4 ECTS credits classroom classes: lectures – 18 hours, laboratory work – 18 hours independent work - 84 hours
Language of teaching	Ukrainian
Requirements for starting the study of the discipline	Knowledge of engineering graphics, theory of automatic control, automation systems of electromechanical systems and elements of an automated electric drive
What will be studied	The discipline studies the peculiarities of using modern software packages used in the design of electromechanical, electrotechnical and electronic devices. During training, candidates will acquire skills in AutoCad Electrical, EPlan Electric and Altium Designer, including creating projects and drawings, editing existing and creating their own component schematics and assembly diagrams, generating reports according to specified templates that allow automatic creation of project documentation, etc.
Why is it interesting/should be studied?	The knowledge and skills acquired while studying the discipline will allow you to lower the entry threshold for employment in design organizations and enterprises that develop the latest electrotechnical and electromechanical automated systems for various sectors of the national economy.
What you can learn	– Develop principle schemes in the above-mentioned programs; – Create diagrams and tables of connections; – Create layout of mounting panels using terminals, PLC and DIN rails. – Generate reports according to schemes; – Create and use various macros; – Edit product databases; – Create printed circuit boards.
How to use acquired knowledge and skills	Acquired knowledge allows you to effectively create design and construction documentation using automation tools in accordance with current standards.
Information support of the discipline	Syllabus, lecture notes, manual for laboratory works.
Semester control	Test

Information technologies in automation

Department that provides teaching	Automation of electromechanical systems and electric drive
Possible restrictions	No restrictions
HE level	First (undergraduate)
Specialties for which the discipline is adapted	141 "Electric power engineering, electrical engineering and electromechanics"
Course	3
The scope of the discipline and the distribution of hours of classroom and independent work	4 ECTS credits classroom classes: lectures – 36 hours, laboratory work – 36 hours independent work - 48 hours
Language of teaching	Ukrainian
Requirements for starting the study of the discipline	Basic knowledge of automation systems, computing and programming languages
What will be studied	The discipline studies information about: the organization of the Internet, methods and tools for developing client and server software applications, database management systems, hardware and software of modern embedded systems, Internet of Things devices, as well as their use for automating the processes of management and control of equipment operation . In laboratory work, students use HTML and CSS to create web pages using the ASP platform . NET Core develops client and server software applications, creates and configures databases, configures single board computers and creates IoT devices based on them.
Why is it interesting/should be studied?	Currently, digitalization and informatization processes are taking place in almost all spheres of human activity, which are aimed at the possibility of monitoring, controlling and controlling various devices, equipment and equipment remotely. The use of the Internet plays a decisive role in this. Therefore, understanding the principles of construction and operation of this network, acquiring the skills to develop Internet software applications, and acquiring the skills to create and operate Internet of Things devices based on single-board computers will significantly improve the qualifications of future specialists.
What you can learn	– create web pages using HTML and CSS ; – develop client and server software applications in the C # programming language using the ASP platform . NET core ; – configure and use databases; – create Internet of Things devices based on single-board computers.
How to use acquired knowledge and skills	The acquired knowledge and skills will allow future specialists to solve a full range of tasks related to digitization and informatization of the processes of control and monitoring of electric power, electrotechnical and electromechanical systems in industry and other spheres of life.
Information support of the discipline	Syllabus, lecture notes, methodological instructions for laboratory work. 1. Documentation. NET [Electronic resource] https://docs.microsoft.com/en-us/dotnet/fundamentals/ 2. ASP.NET Core Documentation [Electronic Resource] https://docs.microsoft.com/en-us/aspnet/core/?view=aspnetcore-5.0
Semester control	Test

Disciplines to choose for the seventh semester

Modeling of electromechanical systems

Department that provides teaching	Automation of electromechanical systems and electric drive
Possible restrictions	No restrictions
HE level	First (undergraduate)
Specialties for which the discipline is adapted	141 "Electric power engineering, electrical engineering and electromechanics"
Course	4
The scope of the discipline and the distribution of hours of classroom and independent work	4 ECTS credits classroom classes: lectures – 36 hours, laboratory work – 36 hours independent work - 48 hours
Language of teaching	Ukrainian
Requirements for starting the study of the discipline	Knowledge of electric drive control, electric drive theory, automatic control theory, electric machines, theoretical foundations of electrical engineering
What will be studied	The discipline studies the peculiarities of mathematical modeling of electromechanical systems based on electric machines of various types. For this, simulation programs are being developed for controlling a direct current motor, an asynchronous motor, and a synchronous motor with permanent magnets. Using the method of mathematical modeling, the peculiarities of the operation of electromechanical systems based on DC and AC motors are studied using different control algorithms, their dynamic, static and energy characteristics are studied. Methods of modeling power electronics elements, rectifiers and voltage converters are studied.
Why is it interesting/should be studied?	Research by the method of mathematical modeling is a mandatory stage in the design, development, modernization of electromechanical systems, as it allows, without the use of expensive physical equipment, to check the correctness of technical decisions made, to determine important operational characteristics, to identify shortcomings and potentially dangerous modes of operation without harming the electromechanical system itself and technological equipment in which it is used.
What you can learn	– develop modeling programs for the study of electromechanical systems; – to develop modeling programs for the study of the main types of technological processes; – understand the dynamic processes that occur in electromechanical systems in different modes of operation; – to investigate static and energy characteristics of electromechanical systems; – understand the processes of setting up different types of engine control systems; – to model voltage converters of electromechanical systems;
How to use acquired knowledge and skills	Investigate (determine) static, dynamic, energy characteristics of electromechanical systems of various technological purposes using a personal computer, without using real expensive equipment.
Information support of the discipline	Syllabus, distance video course, manual for laboratory work.
Semester control	Test

Workshop on vector-controlled electric drives

Department that provides teaching	Automation of electromechanical systems and electric drive
Possible restrictions	No restrictions
HE level	First (undergraduate)
Specialties for which the discipline is adapted	141 "Electric power engineering, electrical engineering and electromechanics"
Course	4
The scope of the discipline and the distribution of hours of classroom and independent work	4 ECTS credits classroom classes: lectures – 36 hours, laboratory work – 36 hours independent work - 48 hours
Language of teaching	Ukrainian
Requirements for starting the study of the discipline	Knowledge of electric drive control, electric drive theory, automatic control theory, electric machines, theoretical foundations of electrical engineering
What will be studied	The discipline studies practical aspects of the construction and operation of vector control systems for alternating current motors. It is revealed how the theory of vector control is implemented in practice, the main functional schemes of power converters, their principles of operation, methods of measurement and formation of feedback signals are given, software implementation of control algorithms is carried out on real experimental installations with a demonstration of their operation.
Why is it interesting/should be studied?	A practically-oriented discipline will allow you to understand how different types of engine control systems are implemented physically, what are their advantages and disadvantages, why, where and why they are used.
What you can learn	– understand the physical principles of operation of vector control systems; – to carry out software implementation of algorithms for controlling engines of various types; – understand the physical principles of operation of frequency converters; – understand the dynamic processes that occur in electromechanical systems in different modes of operation; – to investigate static and energy characteristics of electromechanical systems on experimental installations; – understand the tuning processes of different types of engine control systems.
How to use acquired knowledge and skills	Design and operate vector control systems in various technological applications.
Information support of the discipline	Syllabus, a set of simulation programs, software for automating research on experimental installations.
Semester control	Test

Electromobility

Department that provides teaching	Automation of electromechanical systems and electric drive
Possible restrictions	No restrictions
HE level	First (undergraduate)
Specialties for which the discipline is adapted	141 "Electric power engineering, electrical engineering and electromechanics"
Course	4
The scope of the discipline and the distribution of hours of classroom and independent work	4 ECTS credits classroom classes: lectures – 36 hours, practical classes – 18 hours independent work - 64 hours
Language of teaching	Ukrainian
Requirements for starting the study of the discipline	Knowledge of electric drive control, electric drive theory, automatic control theory, electric machines, theoretical foundations of electrical engineering, modeling of electromechanical systems
What will be studied	The discipline studies the basic principles of construction and operation of electric vehicles with autonomous power and power from a contact network. Features of traction electromechanical systems, coordinate control algorithms of traction electromechanical converters, automation of electric vehicles are considered.
Why is it interesting/should be studied?	Electric vehicles are environmentally friendly vehicles that replace traditional vehicles with internal combustion engines. Electromechanical systems of electric transport have a number of specific features in terms of circuitry, automation and drive motor control that distinguish them from electromechanical systems of general industrial mechanisms and must be taken into account during their development, design and operation.
What you can learn	– the physical basis of the movement of electric transport; – understand the features of electric motors used in electric transport; – to understand the mode of operation of electromechanical traction systems; – understand the structure of the automation subsystem of an electric vehicle; – understand the need for application and implementation of auxiliary subsystems ABS , ESR and others; – to understand the processes of managing the coordinates of drive traction motors of various types; – calculate parameters and choose drive motors, batteries, storage devices on supercapacitors for electric vehicles;
How to use acquired knowledge and skills	Develop, design and maintain electric wheeled vehicles (electric cars, electric bicycles, electric motorcycles, electric buses, trolleybuses, trams, etc.)
Information support of the discipline	Syllabus, lecture notes, lecture notes, manual for practical classes.
Semester control	Test

Interdisciplinary studies of electromechanical systems

Department that provides teaching	Automation of electromechanical systems and electric drive
Possible restrictions	No restrictions
HE level	First (undergraduate)
Specialties for which the discipline is adapted	141 "Electric power engineering, electrical engineering and electromechanics"
Course	4
The scope of the discipline and the distribution of hours of classroom and independent work	4 ECTS credits classroom classes: practices - 36 hours, independent work - 84 hours
Language of teaching	Ukrainian
Requirements for starting the study of the discipline	Knowledge of control of electric drives, theory of automatic control, electric machines, theoretical foundations of electrical engineering, automation systems
What will be studied	In the process of learning, students perform a group project on the development/design of a certain technical system, in which each member of the group is assigned his or her own part of the work. Implementation of such a project is aimed at developing teamwork skills and improving soft skills, as well as at developing the ability to apply knowledge acquired by students in various disciplines.
Why is it interesting/should be studied?	Studying a discipline develops teamwork skills in solving complex technical problems, and also allows to improve understanding and ability to apply knowledge and skills acquired in other disciplines.
What you can learn	– work in a team; – divide a complex technical problem into smaller ones to be solved by individual team members; – develop/project complex technical systems and apply knowledge and skills acquired in other disciplines;
How to use acquired knowledge and skills	Carry out development/design of complex technical systems, perform the role of project leader.
Information support of the discipline	Syllabus, guide to practical classes.
Semester control	Test

Operation and adjustment of electromechanical systems

Department that provides teaching	Automation of electromechanical systems and electric drive
Possible restrictions	No restrictions
HE level	First (undergraduate)
Specialties for which the discipline is adapted	141 "Electric power engineering, electrical engineering and electromechanics"
Course	4
The scope of the discipline and the distribution of hours of classroom and independent work	4 ECTS credits classroom classes: lectures – 54 hours, laboratory work – 18 hours homework - 10 hours, independent work - 20 hours
Language of teaching	Ukrainian
Requirements for starting the study of the discipline	Knowledge of automation systems, logic circuit synthesis, electric drive control, electric drive theory, automatic control theory, electric machines, theoretical foundations of electrical engineering
What will be studied	The discipline studies advanced technologies in electromechanical systems and electric drives, which include modern engineering developments in the field of electric drives for industrial electromechanical systems of various technological purposes, including methods of setting, selecting, operating and connecting equipment and designing industrial electromechanical systems. As well as theoretical information on the principle of setting up complete electric drives and converters in automatic control systems, a description of designs and technological schemes of the main types of electric drives of the ABB company, as well as the features of setting up and operating these devices and their use in real electrical installations at enterprises.
Why is it interesting/should be studied?	In modern enterprises, complete converters of leading foreign manufacturers are increasingly used, therefore, studying the basics of their adjustment, as well as the opportunity to work with them in the laboratory and in practice to learn the skills of adjusting and operating these devices is interesting and necessary for the formation of engineers in our specialty. Also, the opportunity to work with modern equipment in the ABB training center under the supervision of experienced teachers is something that operational engineers from various enterprises agree to pay a lot of money for. Therefore, if such an opportunity is given to a student for free as part of his education, then it is worth using it.
What you can learn	– understand the parameterization of modern converting technology; – make installation and electrical connection of modern industrial converters; – understand the principles of setting the parameters of modern industrial converters and put them into operation; – to investigate the static and dynamic characteristics of electric drives with modern industrial converters; – understand the processes of setting up different types of engine control systems for different technological processes; – work with modern software for setting and monitoring parameters of electric drives.;
How to use acquired knowledge and skills	The acquired knowledge will be useful when working at industrial facilities when putting new equipment into operation, setting up and parameterizing modern industrial equipment for electromechanical automation systems and electric drives.
Information support of the discipline	Syllabus, lecture notes, manual for laboratory works.
Semester control	Test

Economics and organization of production in energy

Department that provides teaching	Department of Economics and Entrepreneurship of the Moscow State University
Possible restrictions	60 people
HE level	First (undergraduate)
Specialties for which the discipline is adapted	For all specialties
Course	4
The scope of the discipline and the distribution of hours of classroom and independent work	4 ECTS credits classroom classes: lectures - 18 hours, practical - 36 hours, independent work - 66 hours
Language of teaching	Ukrainian
Requirements for starting studies	Knowledge of economics at the level of a school course. Possession of a text editor, processing of electronic tabular data. Possession of a mathematical apparatus sufficient for calculations, graphical interpretation and analysis of the obtained results.
What will be studied	Principles of the organization of production activities, elements of the production system, determination of their parameters, assessment of economic efficiency, development of measures to increase it. Basic, maintenance, auxiliary elements of production. Planning, formation and optimization of production systems, evaluation of the synergy of combining elements into a system. Models of energy markets.
Why is it interesting/should be studied?	Understanding the economic component of production activity in combination with engineering education gives a synergistic effect of the competitive advantages of a young specialist in the labor market. The organization of one's own business is one of the ways of implementing the knowledge, skills, and abilities provided by an engineering education. The proposed discipline provides an opportunity to obtain the necessary knowledge to create one's own production, evaluate its effectiveness, plan and implement management actions aimed at increasing competitiveness, as well as successful professional growth in the conditions of work in large companies.
What you can learn	• Calculate economic indicators. • Apply approaches to the organization of production processes, resource provision of elements of the production system. Evaluate the effectiveness of auxiliary, service processes. • Form an effective configuration of the production system.
How to use acquired knowledge and skills	– at enterprises of the energy, electrical engineering and other industries in positions requiring knowledge of technologies and economics, which are now and in the future in acute shortage and highly paid, taking into account the initiated reforms in the energy industry;. – in developing and improving one's own business; – when advising business owners on optimizing the activities of already existing enterprises, taking into account the knowledge acquired during the study of energy disciplines.
Information support of the discipline	Enterprise economics: A study guide/ P. V. Krush, V. I. Podvigina, B. M. Serdyuk, etc. - K.: Elga-N: KNT, 2007. - 777 pp. Sklovska E.G., Serdyuk B.M., Bakhmachuk S.V., Shevchenko T.E. Energy Economics: Textbook. - K.: Karavela, 2019. - 492 p. Kozhemyachenko O.O. Synopsis of lectures on the discipline "Economics and organization of production" for students of 141 "Electroenergetics, electrical engineering and electromechanics" of full-time and part-time study - K., 2018. - 115 p. Presentations, video materials, syllabus are posted on Campus.
Semester control	Test

Organization of production

Department that provides teaching	Department of Economics and Entrepreneurship of the Moscow State University
Possible restrictions	60 people
HE level	First (undergraduate)
Specialties for which the discipline is adapted	For all specialties
Course	4
The scope of the discipline and the distribution of hours of classroom and independent work	4 ECTS credits classroom classes: lectures - 18 hours, practical - 36 hours, independent work - 66 hours
Language of teaching	Ukrainian
Requirements for starting studies	Knowledge of economics at the level of a school course. Proficiency in a text editor, ability to process electronic tabular data. Possession of a mathematical apparatus sufficient for calculations, graphical interpretation and analysis of the obtained results.
What will be studied	Basic principles, principles and methods of organization of material production; Optimization of production processes and time and space; Planning, optimization of time and economic resources in the production process organized in a project format; Planning and optimization of auxiliary and service processes.
Why is it interesting/should be studied?	Organization of production is a process that precedes the implementation of production activities. Correct calculations regarding the volumes and forms of the combination of equipment, labor force, their placement in space are the key to reducing production costs, increasing its efficiency, and, as a result, competitiveness.
What you can learn	Know the essence of production organization and the main methods of increasing its efficiency; Apply the method of calculating the organization of production in time to choose the most effective method of production of a given volume of goods in the specified time parameters; Know the basic principles, requirements and limitations regarding the spatial organization of production; Possess the network planning method for calculating and optimizing the time and resource parameters of production processes in the project format; Evaluate the effectiveness of auxiliary and service processes;
How to use acquired knowledge and skills	- You can use the acquired knowledge: in planning your own business in the field of material production, which is created "from scratch"; - In the modernization of the already existing business in order to achieve the specified time parameters, the limits of the use of economic resources, production areas. - In advising business owners on optimizing the above mentioned parameters.
Information support of the discipline	Enterprise Economics: A Study Guide / P. V. Krush, V. I. Podvigina, B. M. Serdyuk, etc. - K.: Elga-N: KNT, 2007. - 777 p. Sklovska E.G., Serdyuk B.M., Bakhmachuk S.V., Shevchenko T.E. Energy Economics: Textbook. - K.: Karavela, 2019. - 492 p. Kozhemyachenko O.O. Synopsis of lectures on the discipline " Economics and organization of production" for students 141 "Electroenergetics, electrical engineering and electromechanics" full-time and part-time study - K., 2018. - 115 p. Presentations, video materials, syllabus are posted on Campus.
Semester control	Test

Organization of enterprise activities

Department that provides teaching	Department of Economics and Entrepreneurship of the Moscow State University
Possible restrictions	60 people
HE level	First (undergraduate)
Specialties for which the discipline is adapted	For all specialties
Course	4
The scope of the discipline and the distribution of hours of classroom and independent work	4 ECTS credits classroom classes: lectures – 18 hours, practical – 36 hours independent work - 66 hours
Language of teaching	Ukrainian
Requirements for starting studies	Knowledge of economics at the level of a school course. Possession of a text editor, an editor for working with tabular data. Possession of a mathematical apparatus sufficient for calculations, graphical interpretation and analysis of the obtained results.
What will be studied	Basic principles, principles and methods of organization of enterprise activity in the conditions of a regulated market economy; Organization of enterprise activities, starting from the formation of a business idea, registration of business activity; Planning, optimization of production processes in the field of material production, as well as in the field of services; Planning and optimization of auxiliary and service processes, as well as partnership relations in business.
Why is it interesting/should be studied?	Organization of an enterprise is a process that precedes the implementation of a business idea. It is important to have a "road map" with reasoned answers to the following questions: how, where, in what form the enterprise will be registered; How to organize the optimal resource provision of the enterprise for its uninterrupted functioning; How to organize the main production process; How to determine the structure of service and support processes; How to create a favorable external business environment; When it is appropriate to liquidate/merge/unbundle/rebrand the enterprise.
What you can learn	Know the regulatory framework for the organization of the enterprise's activities from business idea to termination of business; Apply the method of calculating the organization of production processes, resource provision of the enterprise; Evaluate the effectiveness of auxiliary, service processes, the expediency of partnership relations.
How to use acquired knowledge and skills	The acquired knowledge can be used in developing one's own business, increasing its efficiency by competently developing a method of organizing the company's activities; In advising business owners on optimizing the activities of already existing enterprises.
Information support of the discipline	Enterprise Economics: A Study Guide / P. V. Krush, V. I. Podvigina, B. M. Serdyuk, etc. - K.: Elga-N: KNT, 2007. - 777 p. Sklovska E.G., Serdyuk B.M., Bakhmachuk S.V., Shevchenko T.E. Energy Economics: Textbook. - K.: Karavela, 2019. - 492 p. Kozhemyachenko O.O. Synopsis of lectures on the discipline " Economics and organization of production" for students 141 "Electroenergetics, electrical engineering and electromechanics" full-time and part-time study - K., 2018. - 115 p. Presentations, video materials, syllabus are posted on Campus.
Semester control	Test

Disciplines to choose for the eighth semester

Industrial electric drives and electromechanical systems

Department that provides teaching	Automation of electromechanical systems and electric drive
Possible restrictions	No restrictions
HE level	First (undergraduate)
Specialties for which the discipline is adapted	141 "Electric power engineering, electrical engineering and electromechanics"
Course	4
Amount	4 ECTS credits classroom classes: lectures – 36 hours, independent work – 84 hours
Language of teaching	Ukrainian
Requirements for starting studies	Basic knowledge in the field of technical mechanics, theory of structural materials, electric machines and devices, theoretical electrical engineering, theory of automatic control, theory of electric drive, control of electric drives
What will be studied	The purpose of the credit module is to study the basics of the theory and principles of technical implementation of automated electric drives intended for equipment and installations of the metalworking and machine-building industries. The subject of study of the credit module is the principles of construction, features of development and implementation of modern industrial electric drives and electromechanical systems. Students will study typical mechanisms of metal-cutting, rolling and forging-press production, calculation methods, equipment selection and design of industrial electromechanical systems, modern trends and achievements in this field. The content of the credit module includes technological information on the processing of metals by cutting and pressing, the study of the designs of the mechanisms of metal-cutting machines, rolling mills, forging and pressing machines, as well as means of automating technological processes.
Why is it interesting/should be studied?	Mechanical engineering and metalworking is a flagship in the application of modern automated electric drive systems and, at the same time, a budget-filling branch of Ukraine. Thanks to the constant development of technologies, it is in these areas that the greatest progress is made in the field of application of modern electric drives and, accordingly, there is a maximum need for qualified personnel.
What you can learn (learning outcomes)	Learning outcomes are students' acquisition of: - knowledge of metalworking technology, types of metalworking equipment, the basics of automation of technological processes in metalworking, trends in the development of modern electric drive of metal cutting machines, rolling mills, forging and pressing machines, principles of technical implementation of typical automation systems of metalworking modes, methods of selecting electric motors and setting up complete electric drives; - the ability to select, adjust and research modern electric drives; - experience of practical work with elements of automated electromechanical systems. Mastering the theoretical and practical parts of the program gives students and future specialists the opportunity to independently develop and modernize electric drives, select and adjust electrical equipment, design automation systems for industrial installations for metal cutting and pressing.
How to use acquired knowledge and skills (competencies)	Acquired competencies allow: - apply acquired knowledge, skills and abilities to design new and modernize existing automated electromechanical systems in the fields of metalworking and mechanical engineering; -carry out design and maintenance of technological installations for processing metals by cutting and pressure; - to use a modern element base in the process of project implementation.
Information support	Study and work programs of the discipline, syllabus, distance course, teaching aids with the Ministry of Education and Culture, electronic notes of lectures, computer workshop
The form of classes	Syllabus, lecture notes.
Semester control	Test

Process management

Department that provides teaching	Automation of electromechanical systems and electric drive
Possible restrictions	No restrictions
HE level	First (undergraduate)
Specialties for which the discipline is adapted	141 "Electric power engineering, electrical engineering and electromechanics"
Course	4
Amount	4 ECTS credits/120 hours (lectures – 36 hours; practical classes – 18 hours).
Language of teaching	Ukrainian
Requirements for starting studies	The educational component requires knowledge of separate sections of the disciplines "Theory of automatic control" (Transformation of structural diagrams, compilation of structural diagrams according to differential equations, synthesis of typical control laws, determination of stability of linear systems, regulators of technological processes) and "Automation systems" (Methods and languages of logic controller programming , programmable logic integrated circuits).
What will be studied	**The educational component aims to teach applicants:** - apply the mathematical apparatus of the theory of automatic regulation for the synthesis of process regulators; - apply modeling programs to study dynamic and static characteristics of technological processes; - use mathematical models of processes to build systems for automatic regulation of technological coordinates; - solve process management tasks using modern equipment. **It will be possible to consolidate the acquired knowledge and skills during the implementation of the RGR on the design of an individual control system of the technological process.**
Why is it interesting/should be studied?	Technological processes are an important component of any industrial automation system. They differ from each other both by physical phenomena (hydraulic, thermal, mass transfer processes, etc.) and by the principle of construction of the regulation system (single-loop, multi-loop, single-channel, multi-channel, processes with many inputs/outputs, etc.). High-quality regulation of the output coordinates of such processes, which in turn is a guarantee of obtaining a high-quality output product, is possible only if students understand the mathematical description of the processes themselves, correct synthesis, adjustment of regulators and design of systems for automatic regulation of technological coordinates. Therefore, for the training of specialists in the field of process management in automatic regulation systems, the study of this educational component is definitely relevant.
What you can learn (learning outcomes)	**After studying the educational component, applicants can obtain the following learning outcomes:** knowledge of the mathematical description of various types of processes; principles of construction of systems of automatic regulation by various coordinates of technological processes; main types of process regulators; synthesis methods of process regulators; principles of process research using mathematical modeling; principles of drawing up process management technological schemes; the ability to compose differential equations that describe processes by known transfer functions and vice versa; the ability to perform the synthesis of technological process regulators; the ability to obtain a mathematical description of processes .
How to use acquired knowledge and skills (competencies)	The knowledge and skills obtained as a result of studying the educational component can be used in the design, research and modernization of industrial automation systems of hydraulic, thermal, process, mass transfer and others, which are widely distributed in all branches of industry. The combination of skills to develop and configure systems for regulating technological parameters of processes and theoretical knowledge in the field of synthesis of regulators will allow the future engineer to work with many technological objects.
Information support	Basic literature: *1. Technical means of automation: training. tutorial: in 2 h. Part 1. Sensor technology / V.V. Tkachev, M.I. Stadnik, V.I. Shevchenko, M.V. Kozar, O.V. Karpenko; MONU, NTU "Dniprovsk Polytechnic". – 2nd ed., supplement. and processing - Dnipro: NTU "DP", 2019. - 144 p.* *2. Ya.I. Prots, O.A. Danyliuk, T.B. Lobur Automation of continuous technological processes. Study guide for technical specialties of higher educational institutions. –*

	Ternopil: TDTU named after Pulyuya, 2008. – 239p. *3. Automation of technological processes and automatic control system: Training manual / Baralo O.V., Samoilenko P.G., Granat S.E., Kovalev V.O. - K.: Agrarian education, 2010. - 557 p.*
The form of classes	Lectures, practical classes.
Semester control	Test

Reliability of electromechanical systems

Department that provides teaching	Automation of electromechanical systems and electric drive
Possible restrictions	No restrictions
HE level	First (undergraduate)
Specialties for which the discipline is adapted	141 "Electric power engineering, electrical engineering and electromechanics"
Course	4
The scope of the discipline and the distribution of hours of classroom and independent work	4 ECTS credits classroom classes: lectures – 36 hours, practical classes – 18 hours independent work - 66 hours
Language of teaching	Ukrainian
Requirements for starting the study of the discipline	Knowledge of electric drive control, electric drive, automated electric drive, electric machines, theoretical foundations of electrical engineering, automation systems
What will be studied	The discipline studies methods of analyzing the reliability of electromechanical systems and ways to increase it. For this, factors that affect the reliability of electromechanical systems and mathematical criteria for reliability assessment are studied. The basics of reliability calculations of electromechanical systems with various types of redundancy are also considered. Issues of reliability of renewable electromechanical systems are considered
Why is it interesting/should be studied?	The issue of analyzing the reliability of electromechanical systems and ways to increase it are relevant both when developing new electromechanical systems and at the stage of modernization of existing equipment. Therefore, this discipline will be useful primarily to those who plan to design electromechanical systems or their components in the future.
What you can learn	– analyze factors that affect the reliability of electromechanical systems; – evaluate the reliability of the main electromechanical system; – evaluate the reliability of electromechanical systems with loaded, unloaded and sliding redundancy; – evaluate the reliability of renewable electromechanical systems.
How to use acquired knowledge and skills	Be able to evaluate the main indicators of reliability and know ways to increase it when designing and modernizing electromechanical systems
Information support of the discipline	Syllabus, lecture notes, practical training manual, distance course.
Semester control	Test

Electromechanical systems and automation of technological complexes

Department that provides teaching	Automation of electromechanical systems and electric drive
Possible restrictions	No restrictions
HE level	First (undergraduate)
Specialties for which the discipline is adapted	141 "Electric power engineering, electrical engineering and electromechanics"
Course	4
The scope of the discipline and the distribution of hours of classroom and independent work	4 ECTS credits classroom classes: lectures – 36 hours, practical work – 18 hours independent work - 6 6 hours
Language of teaching	Ukrainian
Requirements for starting the study of the discipline	Knowledge of electric drive theory, automatic control theory, theoretical foundations of electrical engineering, automatic control of electric drives
.What will be studied	The discipline studies the principles of construction, modes of operation and purpose of automated technological complexes. The nature of the interaction of mechanisms of continuous and cyclic action, the peculiarities of the formation of general and local technological cycles of the mechanisms, the analysis of the nature of the construction of their electromechanical systems are considered. The design principles of automatic control schemes of both the general technological complex and its modules are defined, depending on the needs of the technological process.
Why is it interesting/should be studied?	Knowledge of the material of the discipline allows you to solve the issue of development and research of complex automated industrial complexes in accordance with the requirements of technological processes and the nature of the interaction of their individual mechanisms, to determine the principles of selection of automation elements.
What you can learn	– based on the results of the analysis of the technological process, form algorithms for the operation of control systems for technological objects and their modules; – on the basis of a technical and economic analysis, determine the most efficient systems of electric drives of typical mechanisms that perform the functions of elements of the complex; – based on the results of the analysis of the operating modes of the complex and its components, determine the composition of the equipment for the implementation of the structure of the control system; – to analyze the static and dynamic modes of operation of the mechanisms of the technological complex.
How to use acquired knowledge and skills	Develop and design automatic control systems for technological complexes, taking into account the interrelationships between their individual components. Conducting an analysis of operating modes of electromechanical systems.
Information support of the discipline	Syllabus, lecture notes, practical training guide.
Semester control	Test

Electromechanical systems of continuous transport

Department that provides teaching	Automation of electromechanical systems and electric drive
Possible restrictions	No restrictions
HE level	First (undergraduate)
Specialties for which the discipline is adapted	141 "Electric power engineering, electrical engineering and electromechanics"
Course	4
The scope of the discipline and the distribution of hours of classroom and independent work	4 ECTS credits classroom classes: lectures – 36 hours, practical work – 18 hours independent work - 66 hours
Language of teaching	Ukrainian
Requirements for starting the study of the discipline	The educational component requires prior study of the educational component "Electromechanical systems of typical technological applications". In order to successfully master the material, the applicant is also recommended to have an average score of ***at least 85 in the above-mentioned educational component.***
What will be studied	**The educational component aims to teach applicants:** - based on the analysis of the technological process, perform justification and selection of modern elements of electromechanical systems of continuous action; - perform mathematical modeling of the elements of electromechanical systems of conveyors and turbomechanisms, taking into account the peculiarities of the construction of their electric drives and control objects; - to provide research and analysis of the level of energy efficiency of continuous transport mechanisms; - provide research and analysis of the level of performance of the required characteristics and parameters of the technological process using an automated electric drive.
Why is it interesting/should be studied?	Systems of continuous transport (conveyors and turbomechanisms) are the most widespread mechanisms of general industrial purpose, and are used in many branches of industry (for transporting bulk and artificial materials, in water supply systems of residential complexes and enterprises, and others). The use of modern promising technologies and transport mechanisms (automated metal processing complexes, transport of materials over long distances), significant energy efficiency requirements lead to the need to use modern electric drives, develop new laws of automatic control. Therefore, knowledge of the principles of development, analysis and research of modern systems of continuous transport are relevant.
What you can learn	**After studying the educational component, applicants can achieve the following learning outcomes:** use a systematic approach to analyzing the peculiarities of the technological process and professionally form requirements for the principles of construction of electric drives and electromechanical systems of continuous transport and choose the best option; form the structure of the control system and develop mathematical models of elements of transport systems; develop models of pump and conveyor complexes with different configurations (single and multi-engine conveyors, cascade pump units with parallel and serial connection of pumps); use of methods of assembly and description of hydraulic networks; conduct research on static and dynamic characteristics of transport mechanisms, perform analysis of research results and develop recommendations for the design and modernization of electric drives of transport systems.
How to use acquired knowledge and skills	The knowledge and skills obtained as a result of studying the educational component can be used in the development of new and modernization of existing main high-performance conveyors, modern water supply systems, including in the case of using an extensive hydraulic network; in research and diagnostics of electromechanical systems; when developing energy-efficient operating modes of transport systems, etc.
Information support of the discipline	Syllabus, distance course on the "Sikorsky" platform, tasks for modular control and RGR, manual for practical classes.
Semester control	Test

Optimal control in electromechanical systems

HE level	First (undergraduate)
Course	4
Amount	4 ECTS credits/120 hours (lectures – 36 hours; practical classes – 18 hours).
Language of teaching	Ukrainian
Department	Automation of electromechanical systems and FEA electric drive
Requirements for starting studies	The educational component requires knowledge of separate sections of the disciplines "Theory of automatic control" (Transformation of structural diagrams, compilation of structural diagrams according to differential equations, synthesis of typical control laws, determination of stability of linear systems, controllers of technological processes), "Nonlinear and discrete systems of automatic control" (Synthesis of nonlinear regulation laws, determining the stability of nonlinear systems). In order to successfully master the material, the applicant is also recommended to have an average score of ***at least 85*** in the above educational components .
What will be studied	**The educational component aims to teach applicants:** - choose optimality criteria when designing optimal automatic control systems; - solve linear and non-linear problems of optimal control; - to design optimal management systems. **It will be possible to consolidate the acquired knowledge and skills during the implementation of RGR on designing an optimal regulator for a given electromechanical system.**
Why is it interesting/should be studied?	Optimal control is the selection and implementation of the best program of actions to achieve the desired state of the controlled object (based on its certain initial state) by influencing control parameters. The criterion of such management can be various technical, economic and other indicators of the object's functioning. Optimal control has theoretical, computational and applied aspects. The behavior of the object is described mathematically by equations. When solving problems of optimal control, the ideas of dynamic programming are used. Optimal management is possible only on the basis of the relationship between economic and mathematical models and the iterative human-machine process and their coherence. Optimal management ensures the release of a given volume of products with the lowest costs or the maximization of the economic result, the coherence of economic interests, the approximation of economic activity to the economic optimum.
What you can learn (learning outcomes)	**After studying the educational component, applicants can obtain the following learning outcomes:** knowledge of functionality and its properties; the ability to solve problems of calculus of variations; knowledge of Pontryagin's maximum principle; knowledge of the method of dynamic programming for linear and non-linear systems.
How to use acquired knowledge and skills (competencies)	The knowledge and skills obtained as a result of studying the educational component can be used in the design, research and modernization of optimal control systems of industrial automation systems of hydraulic, thermal, process, mass transfer and others, which are widely distributed in all branches of industry. The principles of optimal control are particularly useful in systems with maximum speed and minimum energy consumption.
Information support	Syllabus, distance course on the "Sikorsky" platform, tasks for modular control and RGR.
The form of classes	Syllabus, lecture notes, practical training guide.
Semester control	Test.