

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

KYIV NATIONAL UNIVERSITY
OF TECHNOLOGIES AND DESIGN

EDUCATIONAL AND PROFESSIONAL PROGRAM
INTELLIGENT SYSTEMS OF RENEWABLE ENERGY
AND ELECTRIC VEHICLES

Level of Higher Education the first (bachelor's) level

Degree of Higher Education Bachelor's degree

Branch of knowledge 14 "Electrical Engineering"

Specialty 141 Power, electrical and electromechanical engineering

Qualification Bachelor of Power, electrical and electromechanical engineering

Kyiv 2021

1. Profile of the educational and professional program

Intelligent systems of renewable energy and electric vehicles

1 – General Information	
Full name of the higher institution and structural unit	Kyiv National University of Technology and Design Department of Computer Engineering and Electromechanics
Degree of higher education and qualification in the language of the original	Higher education level – the first (Bachelor's) level Higher education degree – Bachelor degree Branch of knowledge - 14 Electrical engineering Specialty - 141 Power, electrical and electromechanical engineering
Type of diploma and scope of educational program	Bachelor's degree, single, 240 ECTS credits / 180 ECTS credits for a reduced period of study
Availability of accreditation	Certificate of accreditation of UD № 11005758 dated November 6, 2018
Cycle / level	The National Qualifications Framework of Ukraine is the sixth level
Prerequisites	Complete general secondary education, professional higher education or junior bachelor's degree (junior specialist). According to the Standard of Higher Education in the specialty based on the degree of junior bachelor (OQR of the junior specialist), the University recognizes and recalculates ECTS credits received within the previous educational program of junior bachelor (junior specialist)
Language (s) of instruction	Ukrainian
Duration of the educational program	Until July 1, 2023
Internet - the address of the permanent placement of the description of the educational program	http://knutd.edu.ua/ekts/
2 – The purpose of educational program	
<p>Training of specialists with in-depth knowledge, as well as basic and professional competencies in the field of electrical engineering, aimed at acquiring knowledge, skills and abilities to solve specialized problems in the development, design, maintenance of intelligent systems using renewable and power sources for electric vehicles , as well as to solve practical problems in professional activities, taking into account current trends in the industry.</p> <p><i>The main objectives of the program are:</i> formation and development of general and professional competencies in the field of electrical engineering; providing an organic combination in the educational process of educational, exploratory and innovative components; meeting the needs for basic knowledge of modern technologies in power engineering, electrical engineering and electromechanics.</p>	
3 – Characteristics of the educational program	
Subject area	<p>The program is focused on the formation of applicants for competencies to acquire deep knowledge, skills and abilities in the specialty.</p> <p>Compulsory educational components - 75%, of which: disciplines of general training - 30%, vocational training - 44%, practical training - 13%, learning a foreign language - 13%. Disciplines of free choice of the student - 25%, are chosen from the general university catalog according to the approved procedure at University</p>

Orientation of the educational program	Educational and professional for bachelor's degree preparation.	
The main focus of the program	Emphasis is placed on the formation and development of professional competencies in the field of power engineering, electrical engineering and electromechanics; study of theoretical and methodological provisions, organizational and practical tools for development, design, maintenance of intelligent systems using renewable sources.	
Features of the educational program	The educational and professional program develops theoretical and practical training in the field of development, design, maintenance of intelligent systems in energy. The program is focused on the field of renewable, digital and intelligent energy, distributed electrical networks, power supplies for electric vehicles. A feature of the program is the integration of educational and research activities.	
4 – Eligibility of graduates for employment and further study		
Suitability for employment	Graduates are able to perform professional work as teachers of vocational education, technical specialists in the field of electrical engineering, and can hold the following positions: electrical engineer, engineer for debugging, improvement of technology and operation of power plants and networks, engineer of operational and dispatching service , engineer of dispatching and technological control, substation service engineer, energy engineer, engineer for implementation of new equipment and technologies, engineer for control and maintenance of systems, engineer for calculations and modes, production preparation engineer, repair engineer, research engineer , engineer for analysis of renewable energy facilities.	
Further training	Opportunity to study according to the educational-scientific and / or educational-professional program of the second (master's) level of higher education. Набуття додаткових кваліфікацій в системі післядипломної освіти, підвищення кваліфікації.	
5 – Teaching and assessment		
Teaching and training	Student-centered and problem-oriented learning, learning through educational, industrial and undergraduate practice and self-study are used. The system of teaching methods is based on the principles of purposefulness, binary - active direct participation of research and teaching staff and students of higher education. Forms of organization of the educational process: lecture, practical, laboratory classes, practical training, independent work, consultation, development of professional projects (works).	
Assessment	Exams, tests, tests, course (project) work, oral presentations, reports on laboratory classes, reports on practice, tests, public defense of qualifying work.	
6 – Program competencies		
Integral competence (IC)	Ability to solve specialized problems and solve practical problems during professional activities in the field of power engineering, electrical engineering and electromechanics or in the learning process, which involves the application of theories and methods of physics and engineering and are characterized by complexity and uncertainty.	
General competencies (GC)	GC 1	Ability to abstract thinking, analysis and synthesis.
	GC 2	Ability to apply knowledge in practical situations.
	GC 3	Ability to communicate in the state language both orally and in writing.
	GC 4	Ability to communicate in a foreign language.
	GC 5	Ability to search, process and analyze information from various sources.

	GC 6	Ability to identify, pose and solve problems.
	GC 7	Ability to work in a team.
	GC 8	Ability to work autonomously.
	GC 9	The ability to exercise their rights and responsibilities as a member of society, to realize the values of civil (free democratic) society and the need for its sustainable development, the rule of law, human and civil rights and freedoms in Ukraine.
	GC 10	Ability to preserve and multiply moral, cultural, scientific values and achievements of society based on understanding the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society, techniques and technologies. active recreation and a healthy lifestyle.
Professional competencies (PC)	PC 1	Ability to solve practical problems using computer-aided design and calculation (CAD) systems.
	PC 2	Ability to solve practical problems involving methods of mathematics, physics and electrical engineering.
	PC 3	Ability to solve complex specialized problems and practical problems related to the operation of electrical systems and networks, electrical part of stations and substations and high voltage equipment.
	PC 4	Ability to solve complex specialized problems and practical problems related to the problems of metrology, electrical measurements, operation of automatic control devices, relay protection and automation.
	PC 5	Ability to solve complex specialized problems and practical problems related to the operation of electric machines, devices and automated electric drive.
	PC 6	Ability to solve complex specialized problems and practical problems related to the problems of production, transmission and distribution of electricity.
	PC 7	Ability to develop projects of electric power, electrotechnical and electromechanical equipment in compliance with the requirements of legislation, standards and specifications.
	PC 8	Ability to perform professional duties in compliance with the rules of safety, labor protection, industrial sanitation and environmental protection.
	PC 9	Awareness of the need to increase the efficiency of electrical, electrical and electromechanical equipment.
	PC 10	Awareness of the need to constantly expand their knowledge of new technologies in power engineering, electrical engineering and electromechanics.
	PC 11	Ability to promptly take effective measures in emergency (emergency) situations in power and electromechanical systems.
	PC 12	Ability to use intelligent systems in renewable energy and for power supplies of electric vehicles.
7 – Program learning outcomes		
Knowledge and understanding:		
PLO 1	Know and understand the principles of operation of electrical systems and networks, power equipment of power plants and substations, protective earthing and lightning protection devices and be able to use them to solve practical problems in professional activities.	

PLO 2	Know and understand the theoretical foundations of metrology and electrical measurements, the principles of automatic control devices, relay protection and automation, have the skills to perform appropriate measurements and use these devices to solve professional problems.
PLO 3	Know the principles of operation of electric machines, devices and automated electric drives and be able to use them to solve practical problems in professional activities.
PLO 4	Know the principles of operation of bioenergy, wind, hydro and solar power plants.
PLO 5	Know the basics of the theory of the electromagnetic field, methods of calculating electric circuits and be able to use them to solve practical problems in professional activities.
PLO 6	Understand the basic principles and objectives of technical and environmental safety of electrical and electromechanical objects, take them into account when making decisions.
PLO 7	Understand the importance of traditional and renewable energy for successful economic development of the country.
PLO 8	Understand the principles of European democracy and respect for the rights of citizens, take them into account in decision-making.
PLO 9	Know the requirements of regulations relating to engineering, protection of intellectual property, labor protection, safety and industrial sanitation, take them into account when making decisions.
PLO 10	Know the principles of building intelligent renewable energy systems and power supplies for electric vehicles.
Application of knowledge and understanding (skills)::	
PLO 11	Use application software, microcontrollers and microprocessor technology to solve practical problems in professional activities.
PLO 12	To carry out the analysis of processes in the electric power, electrotechnical and electromechanical equipment, the corresponding complexes and systems.
PLO 13	Select and apply suitable methods for analysis and synthesis of electromechanical and electrical systems with specified parameters.
PLO 14	Be able to assess the energy efficiency and reliability of electrical, electrical and electromechanical systems.
PLO 15	Solve complex specialized problems in the design and maintenance of electromechanical systems, electrical equipment of power plants, substations, systems and networks.
PLO 16	Be able to learn independently, acquire new knowledge and improve skills in working with modern equipment, measuring equipment and application software.
PLO 17	Apply suitable empirical and theoretical methods to reduce electricity losses during its production, transportation, distribution and use.
PLO 18	Apply a modern element base and information and communication technologies for intelligent systems with renewable energy sources and storage.
Formation of judgments:	
PLO 19	Find the necessary information in the scientific and technical literature, databases and other sources of information, assess its relevance and reliability.
PLO 20	To communicate freely on professional problems in the state and foreign languages orally and in writing, to discuss the results of professional activity with specialists and non-specialists, to argue their position on debatable issues.
PLO 21	Understand and demonstrate good professional, social and emotional behavior, follow a healthy lifestyle.
PLO 22	Demonstrate mastery of research skills.

8 – Resource support for program implementation	
Personnel support	All scientific and pedagogical workers who provide the educational program on qualification, correspond to a profile and a direction of the educational components which are taught; have the necessary experience of pedagogical work and experience of practical work. In the process of organizing training, professionals with experience in research / management / innovation / creative work and / or work in the specialty are involved.
Material and technical support	Logistics allows to fully ensure the educational process throughout the training cycle of the educational program. The condition of the premises is certified by sanitary and technical passports that comply with current regulations.
Information and educational support	The program is fully equipped with an educational and methodological complex of all components of the educational program, the availability of which is presented in the modular environment of the educational process of the University.
9 – Academic mobility	
National Credit mobility	Provides for the possibility of academic mobility in some components of the educational program, providing the acquisition of general and / or professional competencies.
International Credit mobility	The program develops prospects for participation and internships in research projects and academic mobility programs abroad. Performed in an active research environment.
Training of foreign applicants for higher education	Training of foreign applicants for higher education is carried out according to accredited educational programs.

2. List of components of the educational and professional program and their logical sequence

2.1 List of components of the educational and professional program of the first (bachelor's) level of Higher Education

Code	Components of the educational program (academic disciplines, term papers (projects), practices, qualification work)	Number of credits	Final control form
1	2	3	4
Mandatory components of the educational program			
General training cycle			
MEC 1	Business Ukrainian language	3	credit
MEC 2	Foreign Language (english , german , france)	12	exam
MEC 3	Ukrainian and foreign culture	3	credit
MEC 4	Philosophy, political science and sociology	6	exam
MEC 5	Physical Education	3/9*	credit
MEC 6	Higher mathematics	12	exam
MEC 7	Probability theory and mathematical statistics	3	exam
MEC 8	Physics	12	exam
MEC 9	Theory of automatic control	3	exam
MEC 10	Computer graphics and multimedia	6	exam
MEC 11	Theoretical foundations of electrical engineering	3	exam
MEC 12	Life safety and civil protection	3	exam
MEC 13	Entrepreneurial business	3	exam
Total of the cycle		72	
Cycle of professional training			
MEC 14	Foreign language of professional orientation (english , german)	12	exam
MEC 15	Electrical machines and apparatus	6	exam
MEC 16	Theory of the electric drive	6	exam
MEC 17	Measurement in electrical power engineering, electrical engineering and electromechanics	6	credit
MEC 18	Electrical systems and networks	6	exam
MEC 19	Applied mechanics	3	credit
MEC 20	Semiconductor energy converters in energy and electric drive	6	exam
MEC 21	Analog and digital electronics	6	exam
MEC 22	Intelligent systems of renewable energy and electric vehicles	6	exam
MEC 23	Microprocessor means of intelligent systems	6	exam
MEC 24	Renewable energy sources and energy storage	6	exam
MEC 25	Mathematical and computer modeling of systems	6	credit
MEC 26	Educational practice	6	credit
MEC 27	Internship	12	credit
MEC 28	Pre-diploma practice	6	credit
MEC 29	Bachelor's thesis (project)	12	attestation
Total from the cycle		108	
The total amount of required components		180	
Selective components of the educational program			
DFCS	Disciplines of free choice of the student	60	credit
The total amount of selective components		60	
TOTAL VOLUME OF THE EDUCATIONAL PROGRAM		240	

* Non-credit academic discipline in 2, 3, 4 semesters.

3. Form of certification of higher education applicants

Forms of certification of higher education applicants	Certification of graduate of higher educational program is carried out in the form of Bachelor's thesis (project)
Document on higher education	Bachelor's degree with educational qualification: Bachelor of Electrical Power Engineering, Electrical Engineering and Electromechanics