



# NATIONAL UNIVERSITY "ZAPORIZHZHIA POLYTECHNIC"



Vivere est cogitare!

Жити — значить мислити!







Zaporizhzhia is a city that embodies the spirit of scientific and technological excellence of Ukraine, reflects the long history of our country, where every corner is full of will, strength, and inexhaustible potential.

Today, Zaporizhzhia is the industrial heart of the country, the leader of industrial development, and National University "Zaporizhzhia Polytechnic" is its driving force. Together with the leading enterprises and institutions of the region, we are creating a new generation of specialists in engineering, technical, economic and humanitarian fields. We are intensively working on the development and implementation of scientific and applied research, creating innovative projects, and leading an active social life.

For more than 125 years, we have been implementing our main mission, which is to educate the young generation of professionals, work for the development of the industry and growth of the economic potential of both Zaporizhzhia region and Ukraine.

National University "Zaporizhzhia Polytechnic" is a source of inspiration and a place of self-realisation for everyone, a powerful community of progressive scientists, an association of like-minded people, a unique centre of innovation.

**Viktor Greshta, Rector of National University "Zaporizhzhia Polytechnic"**

# ЗАПОРІЗЬКА ПОЛІТЕХНІКА

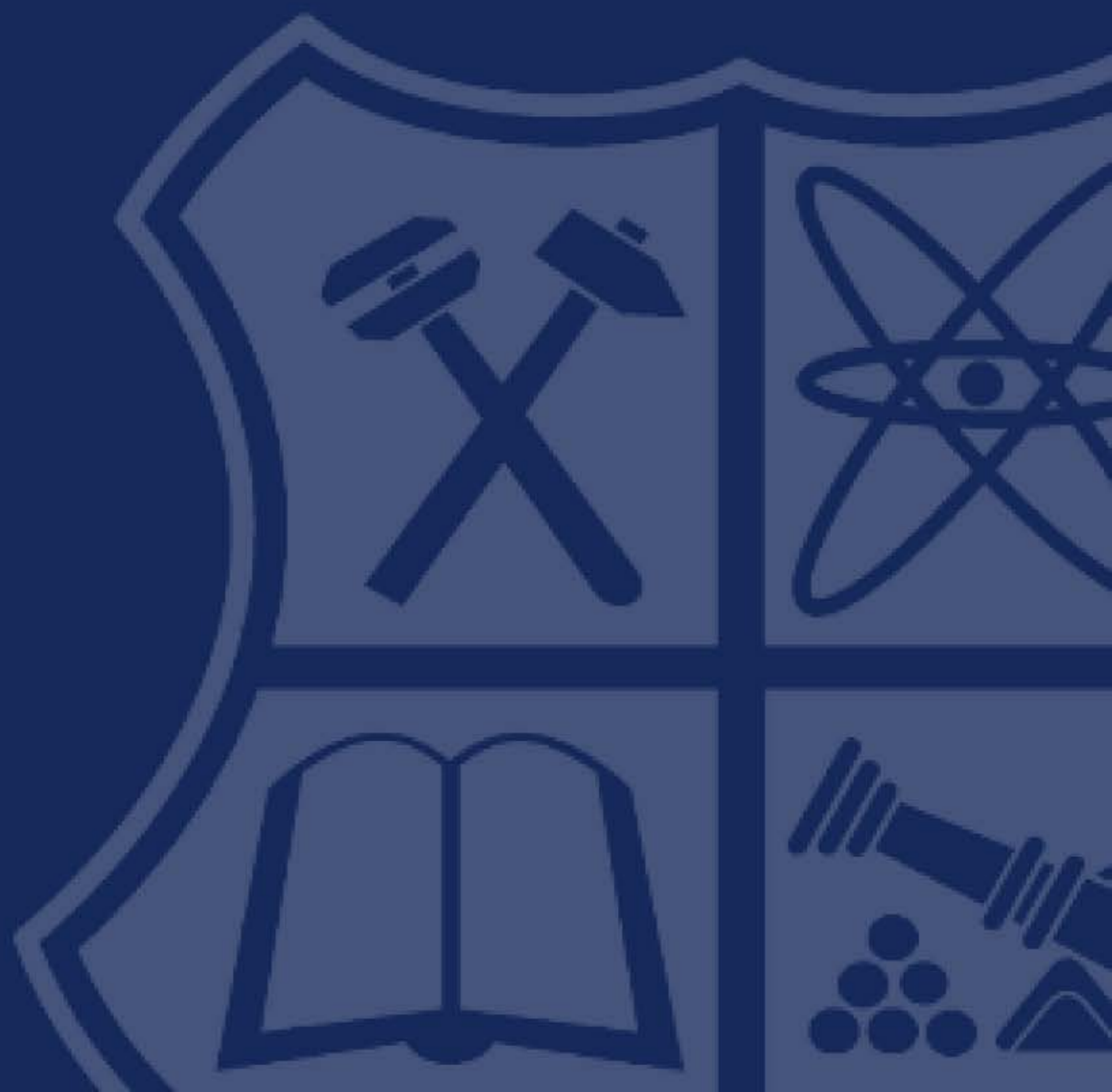


**Zaporizhzhia Polytechnic is a modern multidisciplinary, innovation-oriented scientific and educational complex in the southeastern region of Ukraine.**

Today, the University pursues an active policy of ensuring the synergy of educational, training, scientific, and international activities in generating new knowledge, meeting the demand of regional businesses and authorities for high-quality research, human capital development, and fulfillment of the social city-forming mission.

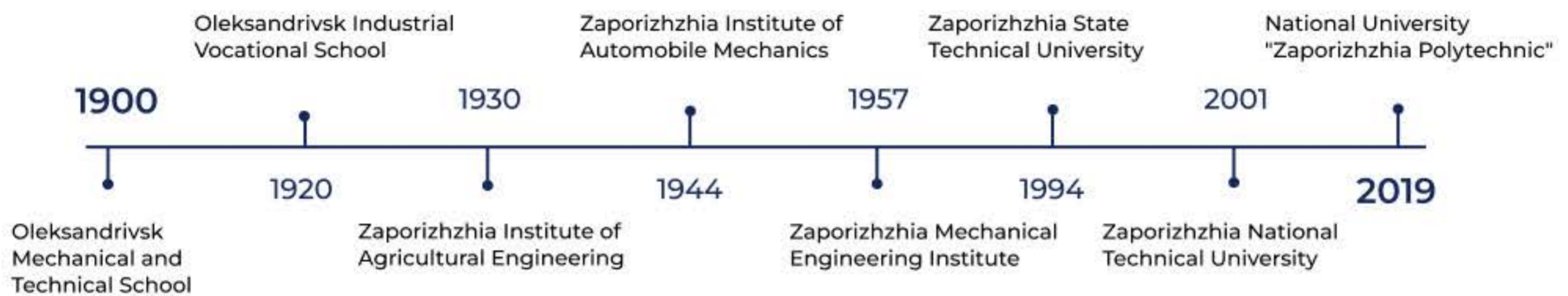
All this makes the successful activity of the University a guarantee of sustainable social and economic development of Zaporizhzhia region and the country.

In terms of the volume of commercialization of activities, projects, grants, and efficiency of use of investments, National University "Zaporizhzhia Polytechnic" has stable positive dynamics among the universities of Ukraine.



# History of the University

The history of our university dates back to 1900. It was then that a seven-grade technical school was established in the county town of Oleksandrivsk (since 1921 – Zaporizhzhia), which trained middle-skilled specialists - mechanical technicians for industrial enterprises.



# University structure



More than 13,000 students study at National University "Zaporizhzhia Polytechnic" in various forms of education at the primary, Bachelor's, Master's, educational and scientific levels.

Both Ukrainian citizens and foreign students study here.

## FACULTIES



### Mechanical Engineering Faculty

- 131 Applied Mechanics
- 133 Mechanical Engineering
- 134 Aviation and Rocket and Space Technology



### Electrical Engineering Faculty

- 141 Electric Power Engineering, Electrical Engineering, and Electromechanics
- 144 Heat Power Engineering
- 171 Electronics
- 173 Avionics
- 174 Automation, Computer-Aided Design, and Robot Engineering



### Faculty of Physics and Engineering

- 132 Materials Science
- 136 Metallurgy
- 131 Applied Mechanics



### Faculty of Information Security and Electronic Communications

- 125 Cybersecurity and Data Protection
- 172 Telecommunications and Radio Engineering
- 174 Automation, Computer-Integrated Technologies, and Robot Engineering
- 175 Information and Measurement Technologies
- 176 Micro- and Nanosystems Engineering



### Transport Faculty

- 133 Mechanical Engineering
- 275.02 Transport Technology (Railway Transport)
- 275.03 Transport Technology (Road Transport)
- 272 Авіаційний транспорт



### Faculty of Computer Sciences and Technology

- 121 Software Engineering
- 122 Computer Sciences
- 123 Computer Engineering
- 124 Systems Analysis



### Faculty of Humanities

- 035 Philology
- 051 Economics
- 292 International Economic Affairs





Faculty of International Tourism and Economics

- 051 Economics
- 241 Hotel and Restaurant Business
- 242 Tourism and Recreation



Faculty of Construction, Architecture and Design

- 022 Design
- 073 Management
- 076 Entrepreneurship, Trade, and Stock Market Activity
- 132 Materials Science
- 191 Architecture and Urban Planning
- 192 Construction and Civil Engineering



Faculty of Economics and Management

- 071 Accounting and Taxation
- 072 Finance, Banking, Insurance, and Stock Market
- 073 Management
- 075 Marketing
- 076 Entrepreneurship, Trade, and Stock Market Activity
- 281 Public Management and Administration
- 017 Physical Education and Sports



Faculty of Social Sciences

- 053 Psychology
- 061 Journalism
- 231 Social Work



Faculty of Management of Physical Education and Sports

- 016 Special Education
- 017 Physical Education and Sports
- 227 Therapy and Rehabilitation



Law Faculty

- 052 Political Studies
- 081 Law
- 262 Law Enforcement

# Academic staff

650

representatives of the academic staff



360 employees with academic degrees and academic titles

105 Doctors of Sciences and Professors

10 employees have the titles of Honoured educators



35 Academicians, and Corresponding Members of Academies of Ukraine (as per field of activity)

230 people have received awards from the Ministry of Education and Science of Ukraine

Most representatives of the academic staff are participants and coordinators of research projects at industrial enterprises and institutions in Zaporizhzhia region.

# Separate structural subdivisions are vocational colleges

The colleges train specialists in the educational and professional programs of the Professional Junior Bachelor's degree.



Zaporizhzhia Electrotechnical  
Vocational College



Zaporizhzhia Vocational College of  
Computer Technologies



Zaporizhzhia Humanitarian Vocational  
College



Tokmak Mechanical Vocational College



Berdiansk Mechanical Engineering  
Vocational College



# Educational Activity

The educational process is focused on training competitive human capital for high-tech and innovative development of Zaporizhzhia region and the country, self-actualization of the individual, and meeting the needs of society and the labour market in qualified specialists.

The study programs are constantly updated to take into account new scientific achievements, technology development, and new needs of the country's and the world's economy.

The University provides conditions for students to create individual educational trajectories. Each student has the right to:

- recognition of the results of previous studies;
- recognition of the results of non-formal and informal education;
- choice of academic disciplines;
- creation of individual curricula and study schedules.



# Individual trajectory

The individual curriculum includes the mandatory study components of the study program, as well as the academic disciplines personally chosen by the seeker of higher education.

The elective courses provide an opportunity:

- to satisfy the educational needs of the seeker of higher education regarding their aspirations and preferences for future professional activities;
- to provide an in-depth study of the courses of disciplines included in the normative mandatory part;
- to improve existing and acquire additional general and professional (special) competencies;

Seekers of higher education choose disciplines via [portal.zp.edu.ua](http://portal.zp.edu.ua), an online service, using the automated university management system and the distance learning platform of National University "Zaporizhzhia Polytechnic".



# Student Victories

Students of our university are regular participants in regional, national, and international projects.

The University ranks first among higher education institutions in Ukraine by the number of prizes in the All-Ukrainian competitions of student research papers and All-Ukrainian student competitions in the fields of knowledge and specialties.



# Modern Educational Technologies

Special attention is paid to modern technologies and digitalization of the educational environment. We are actively implementing VR technologies to create immersive learning experiences and IoT items. Remote engineering, AI, and applications are just some of the many opportunities for innovative technologies that are available for students at our university and help them to better absorb educational content and prepare for future work in the digital economy.

Thanks to these technologies and modern study methods, our graduates are highly qualified, which makes them sought-after employees in the labour market.



# Hands-on Experience

The internship of students at National University "Zaporizhzhia Polytechnic" is a mandatory component of the study program and is aimed at acquiring practical skills in performing typical tasks of professional activity.

Seekers of higher education can get training at enterprises and organizations of the Zaporizhzhia city and the region.

We develop our study programs in cooperation with employers to provide our students with the necessary knowledge and skills that will be used directly in their future professional activities.

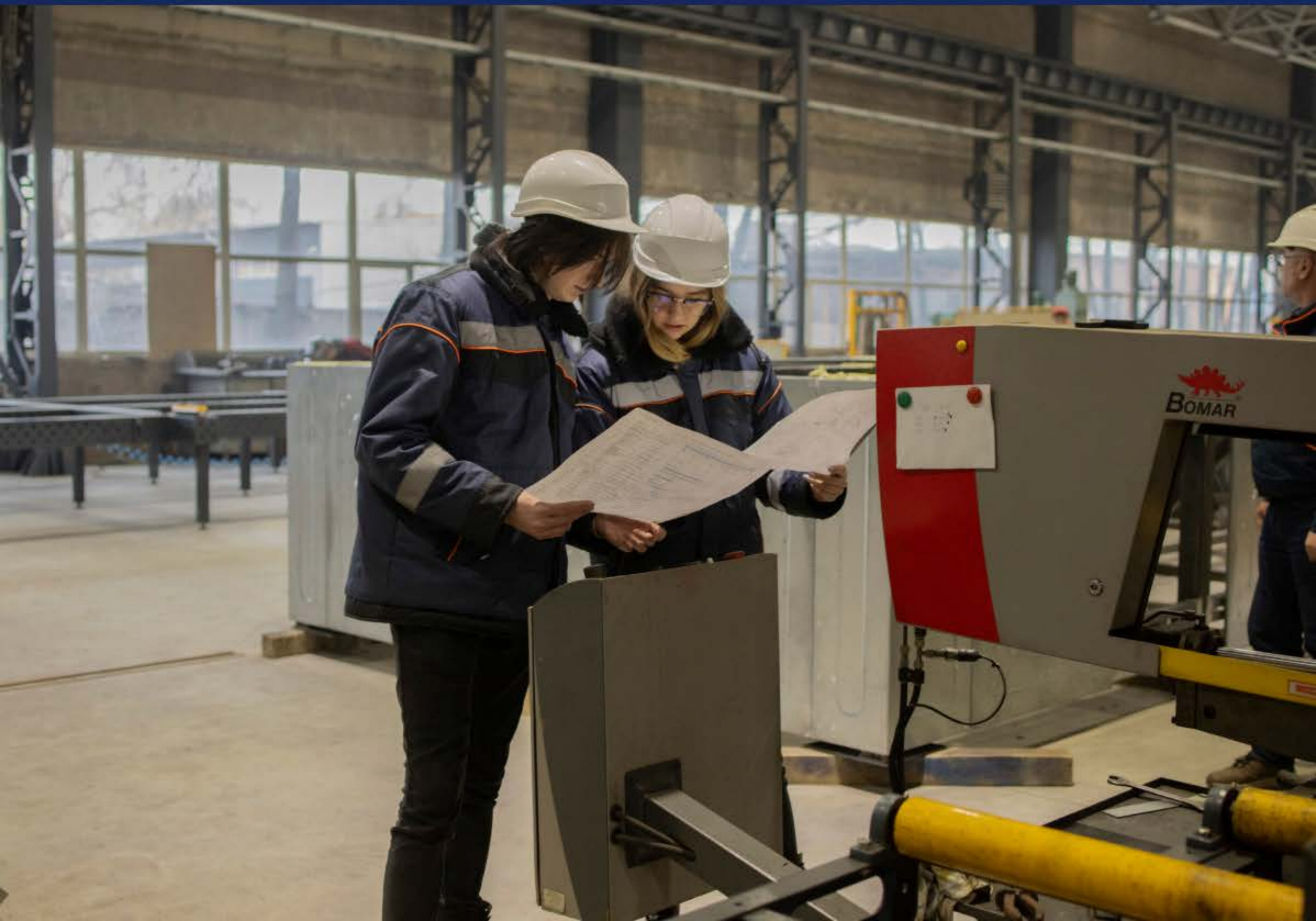




# Dual education

National University "Zaporizhzhia Polytechnic" provides its students with the opportunity to get a dual education with a salary. This process is regulated by a tripartite agreement between the University, the employer, and the student.

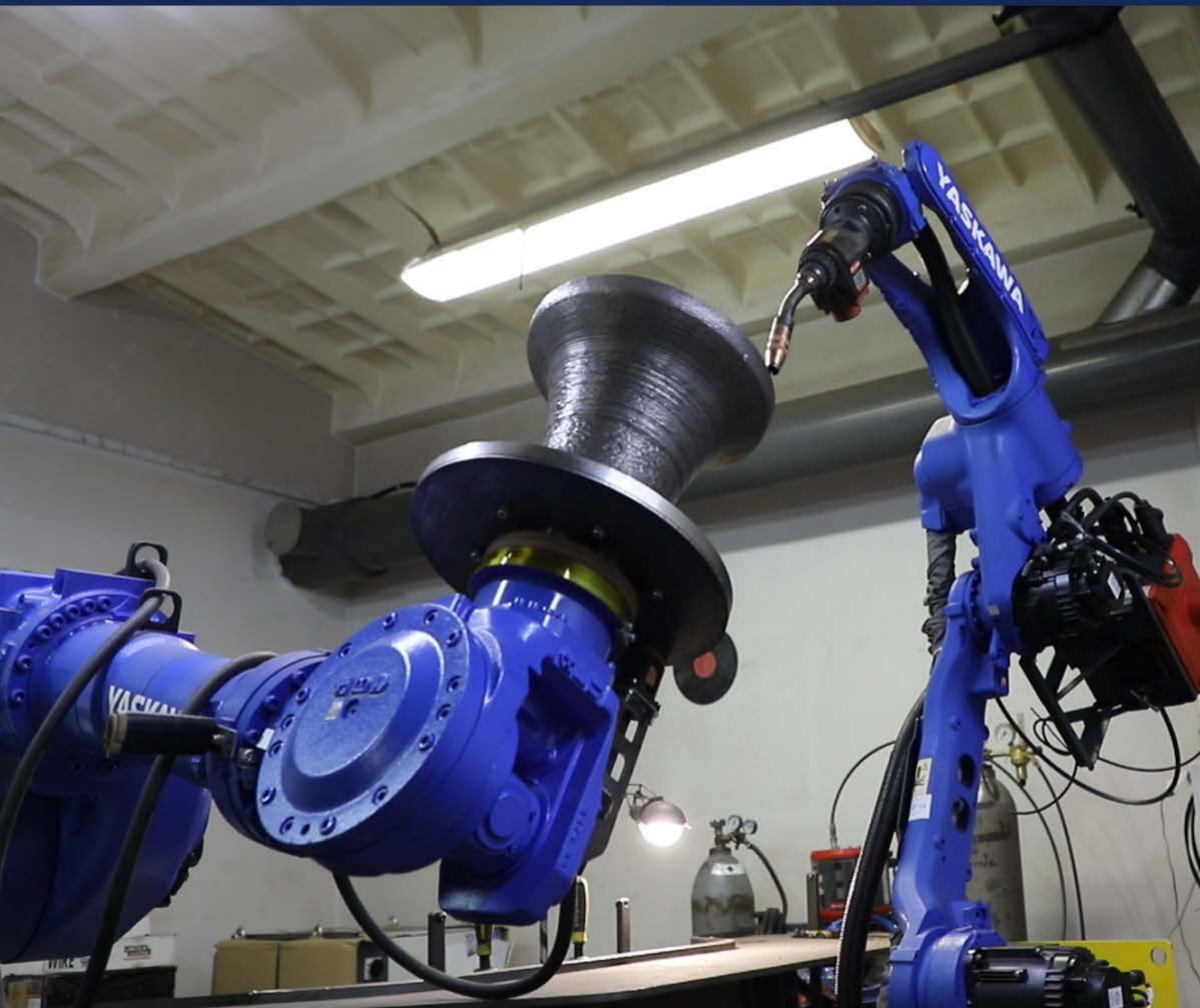
This approach to the educational process allows the employer to influence the employee's educational trajectory at the initial stage of cooperation with the employee and not to waste time and resources on professional adaptation after the successful completion of university study.



# Scientific Schools

National University "Zaporizhzhia Polytechnic" has well-known scientific schools, recognized both nationally and throughout the world.

New creative teams of scientists have been organised and they are successfully developing.



Materials Science and Heat Treatment

Resource Supply for Gas Turbine Engine

Transport Systems and Technologies

Foundry Production

Mechanics of Deformable Solids with Geometric  
and Physical Features

Multilevel Economic Management: State,  
Region, Enterprise

Modern Strategy of Development of a Business  
Entity as a Basis for the Formation of its Economic  
Security

# Research Areas

New Substances and Materials

Power and Energy Efficiency

Information and Communication Technologies

Life Sciences, New Technologies for Prevention and Treatment of the Most Common Diseases

Fundamental Research on the Most Essential Problems of Development of Scientific, Technical, Socioeconomic, Sociopolitical and Human Potential to Ensure Ukraine's Competitiveness in the World as well as Sustainable Development of both Society and the State



# Research and Development

Starting from their student days, our future scientists take part in contests for student research papers, scientific conferences, and research as members of highly qualified specialist teams solving topical scientific and applied problems.

The results of the scientific work of the staff of National University "Zaporizhzhia Polytechnic" are widely used in various sectors of the economy, education, and public life.

## **Scientific Approaches to Improving the Technological and Service Characteristics of the Modernised Composition of ЖСЗЛС-М Alloy**

We have developed and introduced into industrial production ЖСЗЛС-М, a new domestic foundry technological welding corrosion-resistant nickel alloy, which has improved mechanical properties for the manufacture of one-piece parts of TB3-117ВМА СБМ1В aircraft engines. The technological process of industrial melting was tested in industrial conditions. Technical specifications were approved for the developed ЖСЗЛС-М alloy.

## **Development of a New Foundry Welding Heat-Resistant Corrosion-Resistant Nickel Alloy ВХ4ЛМ-ВІ (ЗМІ-М7) for the Manufacture of Critical Parts for Advanced Gas Turbine Units**

The introduction of the new alloys will increase the service life of gas turbine engines by 1.5-2 times and significantly reduce the number of scheduled maintenance outages or replacements. This will significantly improve casting, welding, mechanical, and repair properties compared to the commercially available ВХ4Л-ВІ alloy per OST 1.90126-85. In addition, the manufacture of castings from the developed alloy will reduce the number of rejected parts due to the possibility to eliminate casting defects by welding.

### **Development of Composition, Production Technology and Medical Testing of New Bio-Soluble Magnesium Alloys for Implants in the Human Body**

The composition of a magnesium alloy for the manufacture of surgical metal fixators has been improved. The new magnesium alloy fixators gradually dissolve in the body but retain their functional properties during the fracture healing period. There are no negative reactions from the body, and the process of bone regeneration is not disturbed. Thus, the need for repeated surgery to remove the metal fixators is eliminated.

### **Development of Methods to Increase the Load-Bearing Capacity of Gas Turbine Engine Parts Manufactured Using Additive Technologies**

One of the critical parts of gas turbine engines is the blade, a high-tech, expensive and critical product. Scientists are working on replacing the traditional technology for producing blades and other gas turbine engine parts with 3D printing using special methods to form the required set of performance properties.



### **Ensuring the Quality of Manufacturing Wide-Chord Operating Fan Blades for a Turbojet Double-Circuit Engine with a High Degree of Double-Circuitry to Improve Performance Characteristics**

Technological recommendations have been developed to ensure high performance characteristics of a wide-chord fan of a turbojet double-circuit engine by forming a rational combination of quality parameters of the surface layer of the bearing surfaces of a wide-chord blade at the shaping and finishing stages of its processing, which increase durability and reduce vibration stress.

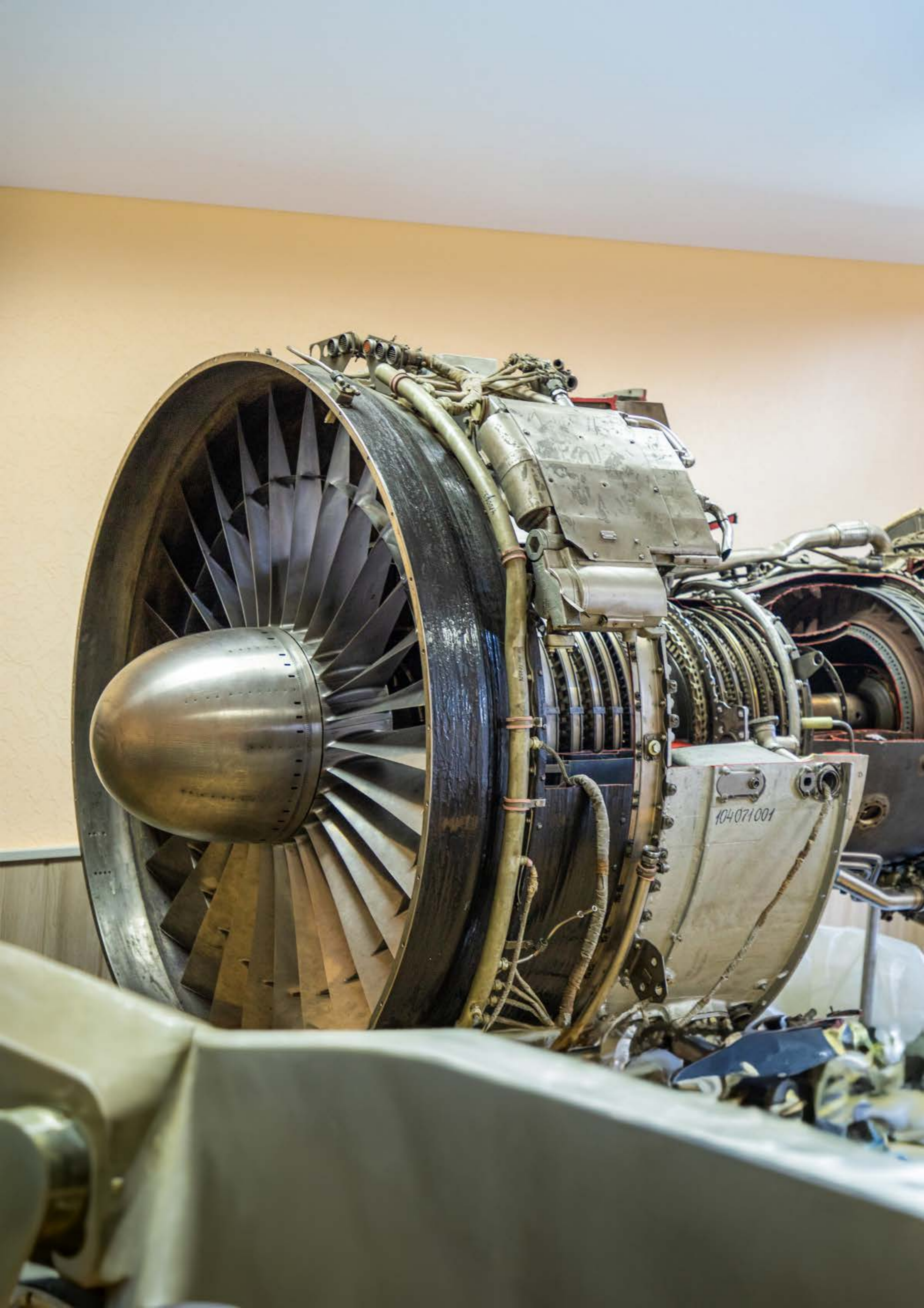
### **Development of a Technology for Recycling Secondary Aluminium Alloys**

An environmentally friendly, low-cost technology for recycling scrap and waste from the production of aluminium and its alloys has been developed. Highly efficient refining and modifying complexes have been invented and manufactured. They make it possible to produce secondary alloys with physical, mechanical, technological and operational properties equivalent to primary alloys. Technical specifications for the production of refining and modifying complexes have been developed and their compositions are protected by patents of Ukraine.

### **Development of New Compositions of Composite Graphitised Steels**

A new class of structural materials – graphitised steels – is being researched. These steels, due to their composition and structure, have the potential to be used in various operating conditions. A number of grades of graphitised steels have been developed for specific operating conditions: 150SD2L – heat-resistant steel for operation under high temperature changes and mechanical loads; 120XS2DL – wear-resistant steel for rolling production. Steel compositions are protected by patents of Ukraine.





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### **Technological Bases for Determining Cutting Modes and Tool Geometry for Final Milling of Thin-Walled Elements of Gas Turbine Engine Parts**

The manufacture of critical aircraft engine parts, which are subject to stringent requirements for specific weight and strength, is accompanied by vibrations that adversely affect tool stability and the quality of parts. The influence of cutting modes and tool geometry on the initial conditions of vibration is investigated. Technological recommendations have been developed to enable productive final milling with high surface quality.

### **Improving the Quality of Parts of Gas Turbine Engines Obtained by Selective Laser Sintering (SLS) by Means of Diamond Smoothing**

Technological recommendations for making use of diamond smoothing to provide high quality of the surface layer of parts obtained by means of SLS of INCONEL 718 nickel alloy and titanium aluminide OX45-3ODS based alloy have been developed.

A set of measures has been developed to reduce porosity in the surface layers of materials obtained with the help of additive technologies to a considerable extent. Found engineering decisions will significantly extend the scope of application of additive technologies in the military and medical fields.

### **Upgrading the Surface Quality and Productivity of Machine Parts Manufacturing Using Finishing Methods**

Service life and reliability of operation of machine parts depend significantly on the quality of surface treatment. Therefore, search and development of new, more efficient methods of finishing treatment is an urgent task for the solution of this problem. Technological recommendations have been developed to make automated locksmithing operations and finishing tasks with the use of polymer-abrasive brushes.



### **Developing and Improving Methods for Effective Assessment of Working Capacity of Structural Materials under Conditions of Multicycle Fatigue**

Methods and recommendations to apply the improved acoustic emission models of cyclical degradation of materials for assessment of working capacity of structural materials of different classes under conditions of multicycle fatigue have been developed.

### **Upgrading the Efficiency of City and Regional Transport Systems and Related Technologies**

Statistical, technical, and economic studies have been carried out to analyse transport systems and technologies used in the infrastructure of Zaporizhzhia and Zaporizhzhia region as a whole. Functioning conditions of urban and regional transport systems as well as technologies for cargo and passenger transporting have been upgraded with the use of methods of statistical and simulation modelling. Measures have been developed to improve the performance of the city and regional transport infrastructure.

### **Improvement of Efficiency and Reliability of Alternating Current Transformation Systems**

New scientifically based approaches to design efficient AC systems have been offered taking into account the asymmetry of power transformers load, their structural features and nonlinearity of properties of active materials. The analysis of factors and their effect on nonuniform distribution of magnetic field energy across the transformer phases and generation of higher harmonic components of currents in power grid networks has been carried out. Also, methodology of designing and making energy efficient structural decisions have been developed. Methods offered have been investigated by means of mathematical modelling and conducting experiments with the use of prototypes and operating transformers. Obtained designs essentially reduce constant and variable components losses under experimental and operating conditions.



## Efficiency of Electromechanical Wind Energy Installations with Aerodynamic Multiplication Systems

The current problem of establishing a connection between the features of wind installations with aerodynamic multiplication and the parameters of the equipment used is considered, allowing an increase in the efficiency of converting wind energy into electrical energy by the electromechanical system.

It is shown that when using geometrically similar generators, the relative indicators of mass, losses, and costs of generators installed on wind turbine blades are significantly lower compared to low-speed generators connected directly to the wind turbine axis.

It has been established that at a constant rotational speed of turbogenerators, there is an effect of auto-stabilisation of the generated power of the wind installation in the operating range of wind speed changes.

The possibility of implementing the said effect when using synchronous and asynchronous generators for direct connection to the grid without converters is demonstrated.

The ways of implementing energy conversion schemes using high-frequency generators and autonomous operation mode aimed at increasing the efficiency of installations have been considered.

We have obtained dependencies of the generated power on the angle of installation of the turbogenerator axis to the plane of rotation of the wind turbine depending on the wind turbine rotation frequency and the wind flow power conversion coefficient, and they allow for maximum energy utilisation.

The research results confirm that wind installations with aerodynamic multiplication can compete with existing wind installations in terms of price and performance, given the best practices in the wind energy industry.



### **Development of Theoretical Foundations for Constructing Complex Mathematical Support of "Digital Twins" of Both New and Existing Power Transformers**

Using AI, fuzzy logic, diagnostics, and monitoring, field modelling, "digital shadows and twins" of operating power transformers, models of loss of service life and localization of damage sites of active parts were developed, while taking into account the entire period of their operation. The scientific, theoretical and methodological foundations of the synthesis and implementation of highly efficient technical solutions were developed in order to significantly extend the service life of power transformers beyond the standard period while ensuring a high level of operational reliability. Based on virtual studies on "digital twins" of existing electrical equipment, additional technical and organisational measures for technical maintenance and ongoing repairs "if needed" were identified, which allow increasing the reliability of power transformers beyond the normalised period, reducing the expenses for upgrading the transformer fleet and overhauling high-cost assets.

### **Charge and Size Effects in Nanostructures and Clusters**

An original method for calculating the volt-ampere characteristics of tunnel structures on metal quantum dots has been developed. For the first time, the calculations were performed using a realistic (non-equidistant) spectrum, due to which it was revealed that the dimensional dependence of the current gap may have a non-monotonic character associated with the clusters' magic.

The theory of optical characteristics of subatomic metal films and wires was constructed. The calculations take into account the specific features associated with dimensional quantization and non-monotonic dependence of the Fermi energy on the thickness.

The effect of deformation and dielectric coating of the metal surface on the energy characteristics of the metal was investigated and it was shown that the dielectric coating leads to a decrease in output and an increase in surface energy.

Codes for self-consistent calculations of electron and positron output (as well as their annihilation characteristics) for metal-dielectric nano sandwiches have been created.





### **Optical and Plasmonic Phenomena in Nanoparticles of Different Geometry and Composites Based on Them**

Recommendations for practical use in nanomedicine and plasmonic catalysis have been developed and proposed.

A computer code for calculating electronic and optical characteristics of layered nanoparticles with spherical and cylindrical shape was created.

A method for calculating the spectral sensitivity of sensors based on surface plasmon resonance was developed.

A methodology for calculating the optical radiation efficiency of layered nanoparticles with various shapes and compositions as components in new generation solar panels has been developed.

### **Software Development of the Research Bench for Testing the Software and Algorithmic Control of the Spacecraft**

The basic modelling process and software models were developed for:

- motion of the spacecraft's centre of mass, the external environment (gravitational and magnetic fields of the Earth);
- command units of control systems: angular velocity metre, magnetometer, star sensor;
- operating units of control systems: control motor flywheel and electromagnet.

An application for visualising the results of modelling was created and the source code of the main classes and functions of the technological computer software was documented using the Doxygen utility.

A software prototype of the control algorithm for the TMS570LS3137 microcontroller and a software interface for data exchange were developed.

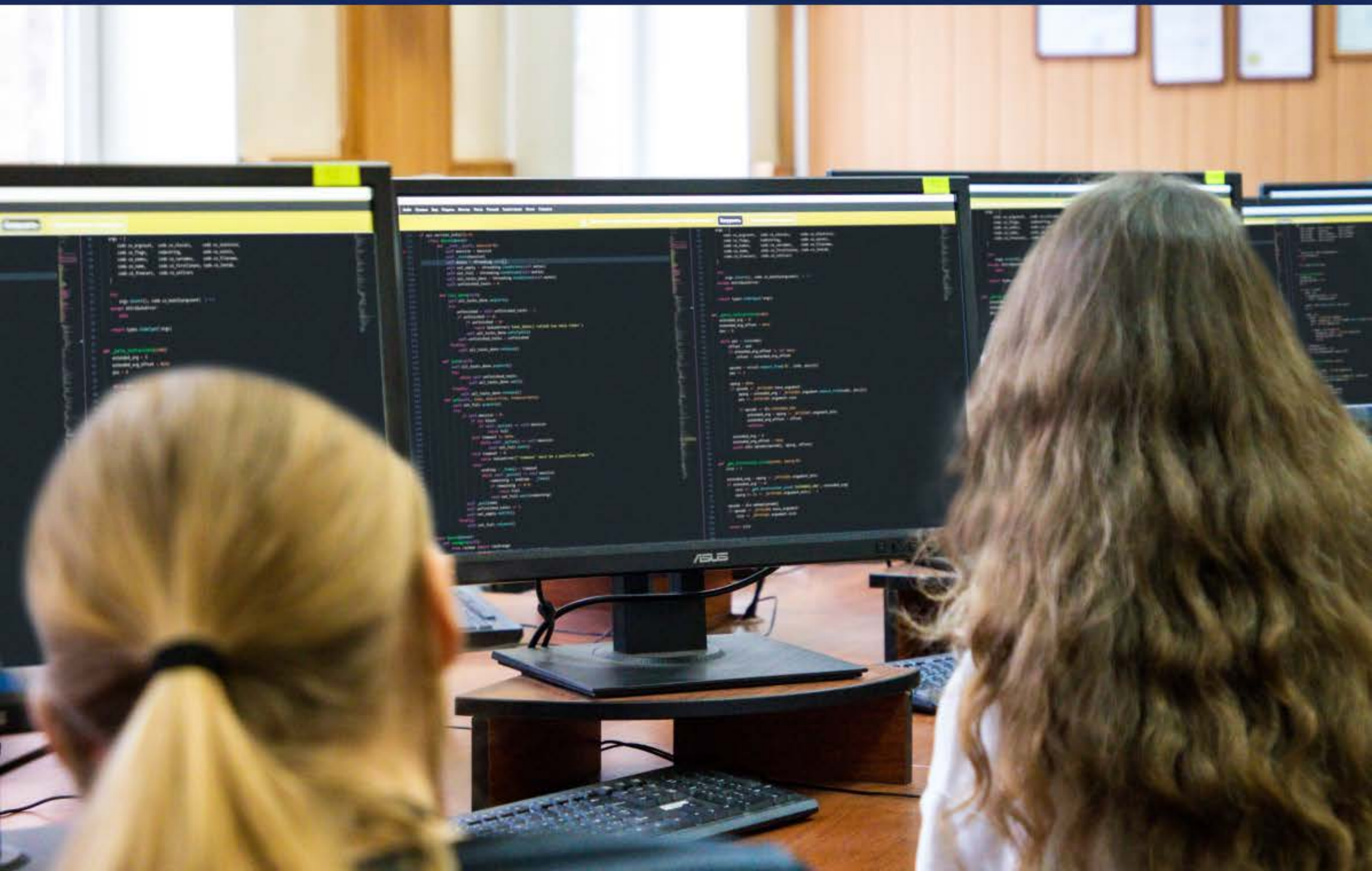
Unit-tests were developed for functions of all classes of software and testing in the Algorithm in a Loop mode as well as testing of the research bench in the Microcontroller in a Loop mode (closed loop mode) were completed.

### Development of Methods and Tools for Analysing and Predicting the Dynamic Behavior of Nonlinear Objects

In order to speed up the process of constructing models of complex objects and processes based on large amounts of data, a new parallel method for structural and parametric model synthesis was developed. The parallel implementation is based on a combination of computational intelligence methods (in particular, the evolutionary approach and neural network technologies), which are well suited for parallelization, and high-performance computing.

To optimise pre-synthesized solutions without highly iterative and resource-intensive stages of retraining and synthesis, a method of structural modification of synthesised diagnostic models was developed.

This method is based on a neuroevolutionary approach using a system of indicators and criteria for adaptive detection of mutational changes, which makes it possible to reduce the resource intensity of the neuromodel by accelerating big data processing.



### **Intelligent Methods and Tools for Diagnosing and Predicting the State of Complex Objects**

A method for coding input diagnostic information that can simplify model construction was developed. Methods of synthesising diagnostic models for technical and biomedical applications were analysed and investigated. A new method for synthesising models based on recurrent neural networks using neuroevolutionary approaches was developed and investigated. Methods of structural optimization of diagnostic models were analysed and investigated.

### **Modern Business Development Trends in Terms of the Economy Digitalization: National and Global Levels**

A comprehensive theoretical and methodological approach to studying the peculiarities of international business functioning in the context of global challenges and digitalization processes was developed.

The current trends in the development of national and global business have been identified, the manifestation of which can be observed in: in the global nature of the economy; a sharp increase in investment in the science and health sector, intellectual capital; focus on sustainable development; transition from capital-intensive to knowledge-intensive type of economic growth; introduction of the latest technologies, innovative processes, products, tools, forms of management; predominant development of the production of intangible values and services; growth in the cost of acquiring information and information technologies; growth in exports of patents, knowledge and creative products; emergence of a new type of enterprise – virtual and digitised goods and services; and growth in social responsibility.

The areas of determining the role of digitalization in external and internal, including intercultural, communications of enterprises and organisations, as well as its impact on the transformation of traditional and development of new areas of economic activity, have been further developed.

Youth entrepreneurship has been studied by generalising the European experience, and a theoretical simulation of youth employment in Ukraine in the context of Industry 4.0 is modelled, the main components of which are health care, renewable energy/energy, education and Lifestyle of Health and Sustainability Sector (LOHAS).

## Formation of the Regional Development Strategy

The methodology for formulating a regional development strategy has been improved, which has allowed for better analytical processing of information using qualitative and quantitative methods. The scientific results were implemented in the development of the Zaporizhzhia region development strategy and the development strategy for territorial hromadas (communities) in Zaporizhzhia region.

The model of demographic changes in the territorial grouping has been improved and a conceptual model of the state policy of human capital formation in the innovative renewal of the region's economy has been proposed.

The obstacles to the development of small, medium and large businesses have been systematised and methodological approaches to accounting, auditing and taxation in the management of business entities in the context of European integration have been developed.

There has been developed a model of knowledge management with defined methodological approaches to building a human capital knowledge management loop from marketing research to creating a new form of human capital of an economic entity.



### **Elaboration and Improvement of Legislation Regarding Ukraine's Integration into the World Community**

Considering Ukraine's strong desire to implement the course of European integration and resume effective cooperation in priority areas, which should eventually lead to the status of a full EU member, and the relevant support of the EU institutions and EU member states for Ukraine's European aspirations, the task of elaborating and improving a complex, multi-level system of legal support for Ukraine's participation in the processes of European interstate integration is being carried out.

To implement this strategic goal, domestic legal doctrines, tools, and organisational and legal procedures are being developed.



### **Elaboration and Improvement of the Mechanisms for Implementing Private and Public Law**

Patterns of historical development of law sources and the consolidation of private and public law provisions in them are being studied.

The criteria for dividing law into public and private are being analysed. The theory of dividing law into public and private is a multidimensional phenomenon, with both theoretical and practical value.

At the same time, the problem of the correlation between private and public law is essential because its resolution will solve many urgent practical issues, including the possible limits of state interference in the economy and people's private life.

### **Journalism in Ukraine and the World: Current Status and Development Prospects**

As a result of the research conducted, theoretical foundations have been elaborated that complement the existing approaches to the study of information activities, media challenges of the present (analysis of media literacy and media security discourses), and the role and functions of media in the political socialisation of young people.

The features of the development of critical thinking and fact-checking as the basis for forming media culture and the psychological health of modern youth, as well as innovative formats of media education in the era of information and communication technologies, have been analysed.

The main approaches of advocacy journalism that are able to counteract propaganda narratives in the media space have been outlined.

The sociocultural role of journalism and the transformation of the functions of news telegram channels during the war have been characterised; the problems of information security of Ukrainian society under martial law have been studied.

### **Current Problems of Speech and Language Development and Correction in People with Psychophysical Disorders**

Methods of forming, developing and correcting the speech of people with psychophysical disorders have been researched and relevant programmes have been developed. Scientific developments in this area are being implemented in the practical activities of educational institutions and child development centres. Methods, techniques and programmes are being adapted to the conditions of a particular institution, and the issue of effective individualisation of the educational process for children with special educational needs is being studied.

### **Augmentative and Alternative Communication in the Rehabilitation of Patients with Aphasia**

Research on the development of alternative and augmentative communication (AAC) in patients with aphasia caused by trauma and/or vascular damage to the brain is being conducted. The developed methods for speech and language correction can significantly improve the quality of life of patients through the use of alternative communication tools.





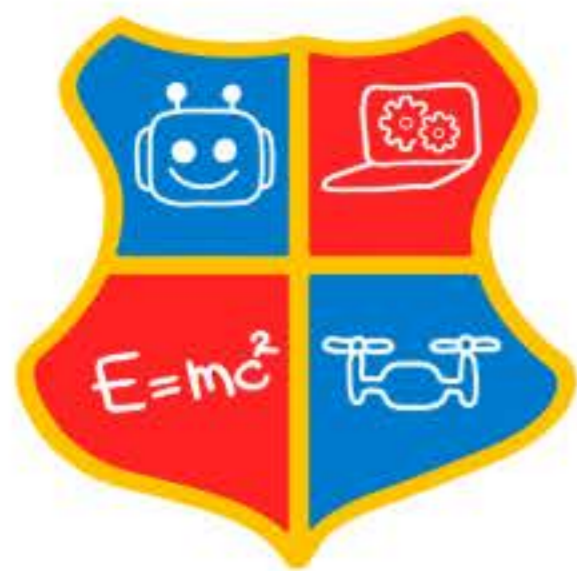
# Noosphere Engineering School

This is a network of scientific and technical laboratories based at Ukrainian higher education institutions, opened and equipped by the NGO Association Noosphere.

Noosphere Engineering School creates an effective start-up platform for young professionals in Ukraine and integrates scientific approaches into the business environment. The Noosphere Engineering School laboratories are centres of engineering creativity where students and young engineers of Ukraine can develop their innovative ideas, receiving technological and marketing support, as well as support from experienced Noosphere mentors and experts.

The School supports young innovative startups and helps them develop world-class products in Ukraine. The main tool is the efficient interaction among students, mentors, technical experts and business practitioners. On a volunteer basis, teachers share scientific techniques for solving business problems and expanding opportunities for Ukraine's future entrepreneurs and scientists.

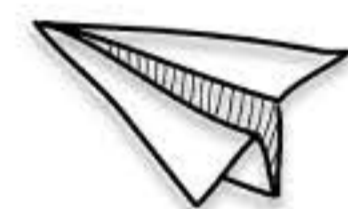




# Children and Youth Scientific University "Zaporizhzhia Polytechnic"

Our strategy is a conscious choice of the future profession and university based on the formula "Zaporizhzhia School – Zaporizhzhia Polytechnic – Zaporizhzhia Employer". Obtaining a quality education and guaranteed employment at enterprises and institutions of Zaporizhzhia will help preserve the intellectual potential of the city and the region as a whole.

The goal of the Children and Youth Scientific University "Zaporizhzhia Polytechnic" (CYSU ZP) is to facilitate the comprehensive development of young people through educational and scientific events and to extend career guidance activities, which will allow students to consciously choose their future profession.



## Main Areas of CYSU Activity include:

- 1. Club work** which means organising regular classes of professional groups for different ages.
- 2. STEM centre** which provides cooperation between the university and general secondary education institutions to implement the concept of developing science and mathematics education (STEM/STEAM/STREAM education).
- 3. The Centre for Gifted Youth** which is there to create a system of extracurricular education for young people based on the student-centred approach, which guarantees favourable conditions for the harmonious development of individuals, the manifestation of their own talents and abilities, and the satisfaction of their interests and spiritual needs.
- 4. Organising and conducting educational and scientific events** (contests, olympiads, conferences, engineering and creative competitions, tournaments, festivals, hackathons) at various levels.

At CYSU 5-11 Grade Students acquire knowledge and skills in drone control, robotics, mechatronics, 3D modelling, automotive and transport technologies, physical materials science, technical design, physics, IT literacy, web technologies, design, ecology, economics, foreign languages, psychology, sociology, law, Ukrainian studies and history.



# Helicopter and Aircraft Engines

In the laboratory, there are full-scale engines: D-36 turbofan engine, RD-45 turbojet engine, centrifugal compressor, S-300 starter, AI-20 turboprop engine, AI-25 turbofan engine, TB3-117 and TB3-117-CBM1 turboshaft engines in section. This provides a more visual and detailed study of the parts of engine components and assemblies, the AI-8 auxiliary power unit, and the components of the annular combustion chamber

The engines, components and units are used both for laboratory classes and practical workshops and as auxiliary materials in the research conducted by Master's degree students, department staff and postgraduate students.

## The Latest Aviation Technologies

The main activity of the laboratory is aimed at increasing the durability of parts of aircraft engines and stationary power plants of the new generation.

Laboratory classes and practical workshops on the construction of solid models and modelling of physical processes are conducted on modern personal computers. For this purpose, the following software packages are used: AutoCAD, UnigraphicsNX (modelling module), Mathcad 15, ADEM 7.1, and ANSYS 14.5.

**CAUTION!**  
BEFORE SWITCHING  
ON THE AC POWER  
ENSURE GROUND  
POWER CB IS ON

GENERATOR EXTERNAL POWER  
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**FIRE EXTINGUISH**  
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ENGINE RIGHT  
FIRE EXT SYST  
FIRE WARN

121 0/3  
THU

**ANTI-ICING SYSTEM**

MANUAL  
ON OFF  
LEFT ENGINE HEAT  
RIGHT ENGINE HEAT  
W/W

**FUEL PUMPS**

REFUEL CHECK  
SERVICE TANK  
LEFT TANK  
RIGHT TANK  
ON OFF

W/S WIPER  
START RESET  
SPEED2 SPEED1

GYRO HOR  
ON OFF  
HEATING CONTROL BATT  
HEATING CONTROL PITOT

LEFT VALVE CLOSED  
RIGHT VALVE CLOSED  
**CAUTION!**  
DO NOT START ENGINE UNTIL CONTROL IS

Wiring diagrams and labels for electrical components, including a fuse block.

AVIA GRADE

ZAPORIZHZHIA

POLYTECHNIC



# Tempus DesIRE



Development of Embedded System Courses with implementation of Innovative Virtual approaches for integration of Research, Education and Production in UA, GE, AM  
[www.tempus-desire.eu](http://www.tempus-desire.eu)

## Zaporizhzhya National Technical University project partner «DesIRE»

### Wide Objectives

- To change the theoretical type of learning in Ukraine, Georgia and Armenia to practice-oriented competence-based approach.
- To speed up integration between Higher Educational Institutes and business in target countries
- To establish cooperation between EU and target countries in education and research.

### Specific Project Objectives

- To create practice-oriented curricula and modules in Embedded Systems:
  - ✓ Embedded Operating Systems
  - ✓ Management and Marketing for Engineers
  - ✓ Engineering
  - ✓ Software Development



# Precision Research Methods

The laboratory carries out electron microscopic studies using a scanning electron microscope REM-106I with an energy dispersive analysis system, which makes it possible to determine the chemical composition in microscopic volumes with an error of no more than  $\pm 1\%$ . Determination of the chemical elements distribution by structural components allows prediction of material properties. It is also possible to examine the microstructure with a resolution of 3 to 20 nm, at accelerating voltages of 1 to 30 kV and a depth of focus of up to 0.5  $\mu\text{m}$ . This resolution allows examination of fractured surfaces and determination of the cause of fracture and structure at magnifications of 100 to 30,000 times.

# X-ray Structural Research Methods

They are used to gain theoretical and practical knowledge of phase analysis techniques. The laboratory is equipped with a modernised X-ray unit with automatic identification of the structural components of metals and alloys.

The results of X-ray structural research allow studying the influence of chemical composition, heat treatment, and plastic deformation on the phase composition, subgrain structure, and stress-strain state of metallic materials for the purpose of further controlling the physical and chemical properties of new steels and alloys.





# Long-Term Tests

The laboratory is used for long-term tests of modern heat-resistant materials for exact technological purposes of gas turbine units products.

The study of the long-term strength characteristics and material creep makes it possible to predict the operational stability of GTE parts, which are made of developed heat-resistant materials at elevated operating temperatures and severe dynamic loads.

# Dynamic Studies of Cutting Processes

The laboratory is adapted to carry out complex high-tech tests at high rotation frequencies during turning and milling processes, which reduces self-oscillation to improve the quality of surface treatment and significantly increase the stability of the tool.

A modernised CNC milling machine worth more than UAH 5 million, equipped with a low-noise electric spindle with a power of 40 kW, a rotation frequency of 9,000 rpm with an accuracy of 0.005 mm. The CNC control system from the West Lab company allows milling in four coordinates at the same time. Milling samples from various materials are being researched with the definition of constancy zones.



WL

WL4M

DSP inside

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F1 F2 F3 F4 F5 F6 F7 F8 F9 F10

EMERGENCY STOP

Emergency stop button (red)

Start button (green)

Stop button (red)

Feed hold button (yellow)

Other control buttons (black, red, green)

# Laboratory of Metal Cutting Machines

The educational laboratory is aimed to prepare future specialists in metalworking equipment and systems of competencies and practical skills in the design, operation, and programming of modern machines, in particular, equipped with CNC systems.

The educational laboratory is equipped with milling, turning, tooth-working machines, a robotic turning complex, an engraving-milling machine with CNC. Students have the opportunity to study the designs of modern elements of machine tools, such as motor-spindles, guides, running screws, etc. on industrial models of the "cut-away" type. The available computerised complex allows studying the components of cutting forces and cutting temperature during turning and flat grinding. The specified equipment is used in scientific research of cutting processes, during research within the framework of diploma projects and for studying such disciplines as "Theory of Cutting", "Metalworking Equipment", "Software Control Systems", "Operation and Maintenance of Machine Tools", "Measuring Systems", etc. In addition to the educational process, under the "Metal Cutting Machines and Systems" study programme, the laboratory hosts clubs, courses, master classes on 3D modelling and software processing on aggregates for schoolchildren and adults as part of non-formal education programmes. For this purpose the modern licensed software Robo DK Tebis is used.

The laboratory occupies two study rooms, one of which is equipped with computers.



# Equipment and Technologies for Traditional and Powder Metal Forming

The educational laboratory Equipment and Technologies for Traditional and Powder Metal Forming is equipped with stands, appliances, tools, and equipment for conducting laboratory and practical classes in all academic disciplines provided by the study program Equipment and Technologies for Plastic Forming of Mechanical Engineering Structures. In particular, there are mechanical and hydraulic presses, a horizontal forging machine, a cold-forming machine, furnaces, machine tools for machining, lifting mechanisms and machines, means of automation, mechanisation and robotization, a compressor station, etc. In addition, the laboratory has a full range of necessary main and auxiliary equipment for manufacturing parts using powder metallurgy.

The available equipment enables one to conduct research and design: sheet metal stamping technology (cutting, punching, stretching, bending, etc.); hot forming technology (free forging, forming, deposition, extrusion etc.); technology for forming products from powder metal materials (pressing, rolling, extruding, hydrostatic pressing, etc.) and research aimed at improving forging and stamping equipment.



# 3D Modelling

The availability of modern 3D printers and computers allows us to conduct training of higher education students in design automation at enterprises engineering industry, including the design and manufacture of products using additive technologies.

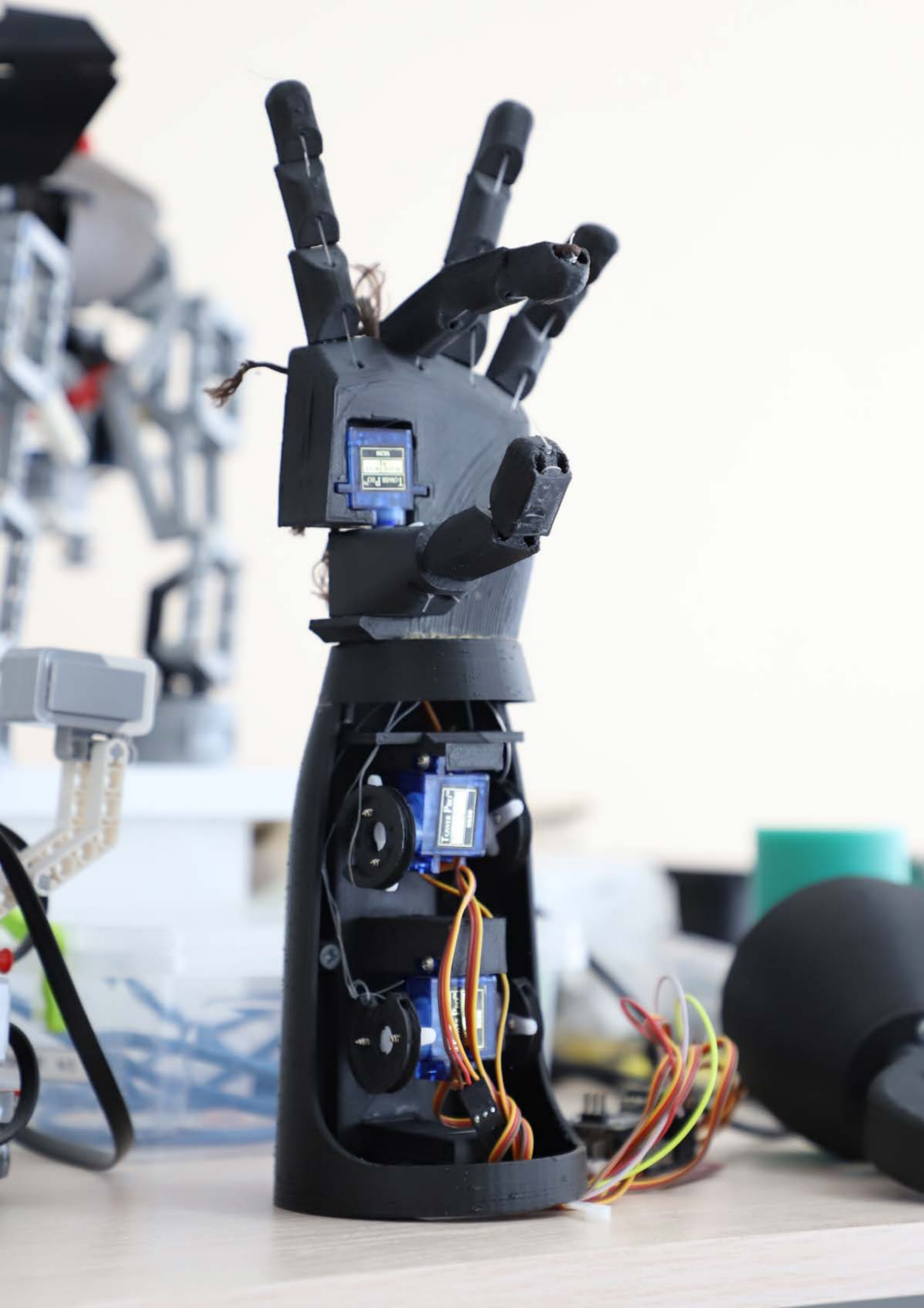
The available software allows you to calculate the properties of products after various types of processing using the finite element method to significantly increase the research efficiency .

# Embedded Systems and Remote Engineering

The laboratory was created as part of the DESIRE project Development of Courses on Embedded Systems Using Innovative Virtual Approaches to Integrate Science, Education, and Industry in Ukraine, Georgia, and Armenia.

The laboratory is equipped with modern appliances for studying embedded systems – a laboratory server, computers, various software and hardware platforms (Arduino, Altera Cyclone, and Raspberry Pi), platforms for learning Formula Flowcode Buggy robotics, Leapfrog Creatr HS 3D printer, Gotcha 3D, 3D scanner Gotcha, and GOLDI remote-controlled experiments. On the one hand, this equipment provides access to real physical systems with the option of programming them to simulate the operation of real devices (conveyors, elevators, or smart homes) and, on the other hand, this equipment allows a remote access, which is most relevant in the time of distance learning.





# Laboratory of Information Security

The laboratory is intended to develop practical skills in protecting computer systems, networks, and software products (software) for future cybersecurity specialists.

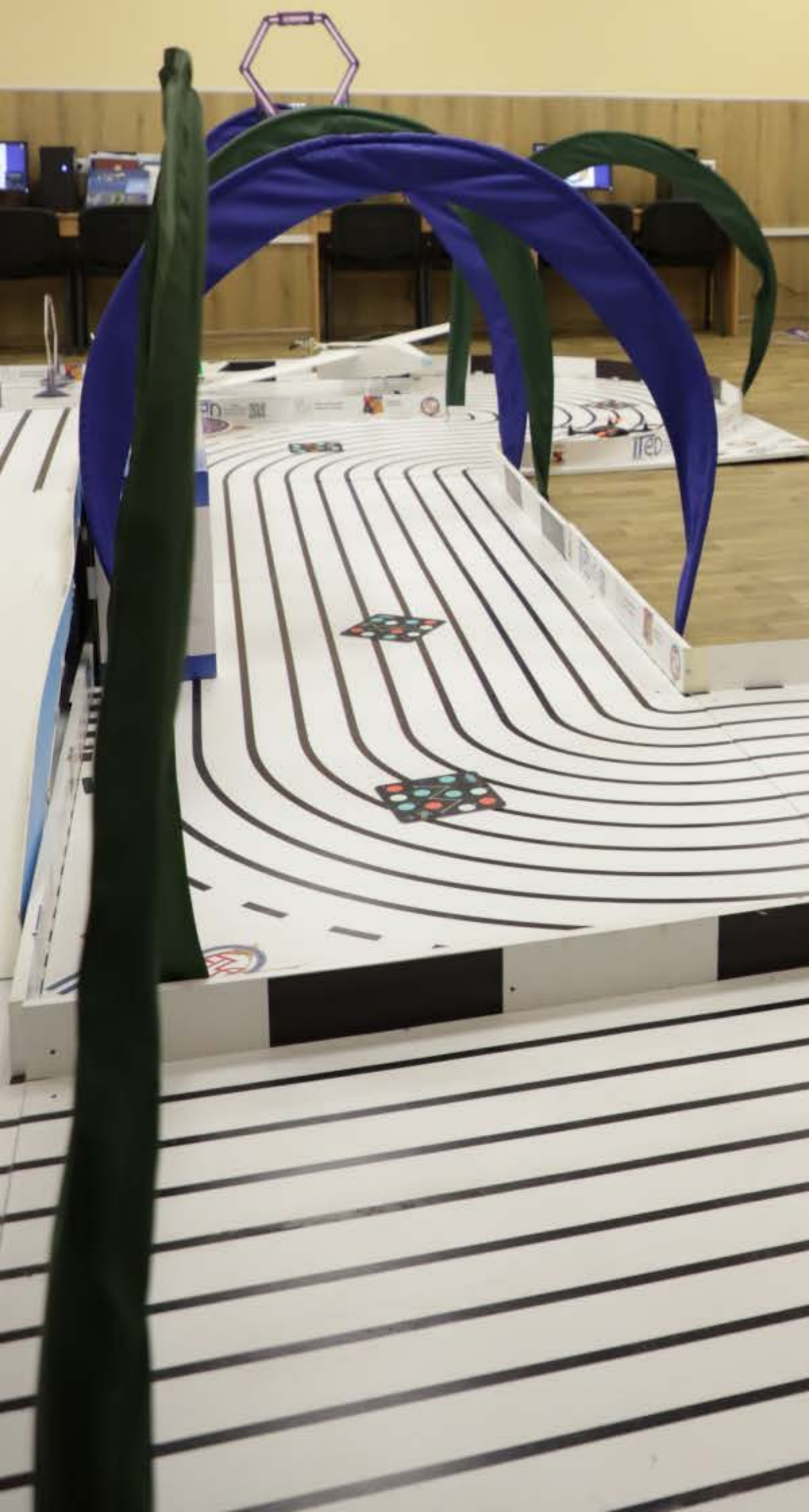
The laboratory enables research into actual cyber attacks, testing security vulnerabilities, training hacking techniques in a controlled environment, and developing security tools to improve the security of computer systems.

# Unmanned Technologies and Avionics

The laboratory is equipped with a unique stationary track for preparing and conducting contests in robotics. Its structure allows changing the trajectory and difficulty level to meet certain requirements, and adding unmanned mobile platforms.

The laboratory provides high-quality training in flight simulation mode, programming flight controllers, and creating control systems for them. Students work with avionics emulators used in real aircraft and helicopters. They also create original diploma and startup-projects/

“School of Drone Operators” functioning in the framework of the lab offers training on piloting industrial and domestic drones, both independently controlled and in an FPV mode.





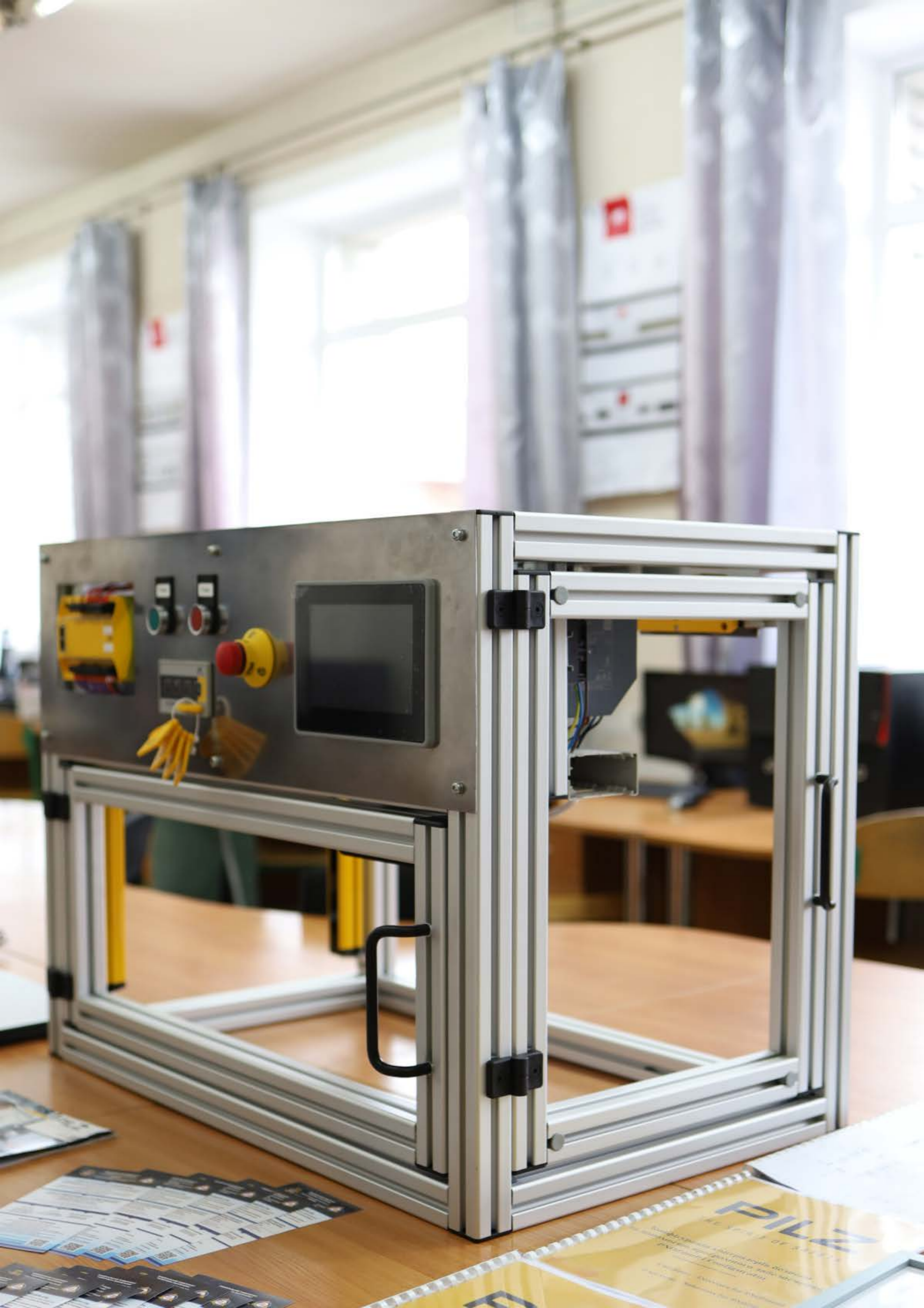
SA6



6GHz Spectrum Analyzer & Signal Generator

MKR MENU  
FREQ AMPL  
← →  
↓ ↑  
- SPAN +

87.29



# Computer Laboratory of Digital Twins

Owing to the partnership with leading Ukrainian and world companies the laboratory is equipped with powerful computers with licensed Typhoon HIL software (creation of digital twin and real-time systems, development of power electronics and control systems), EPLAN (design of electrical control cabinets and distribution cabinets).

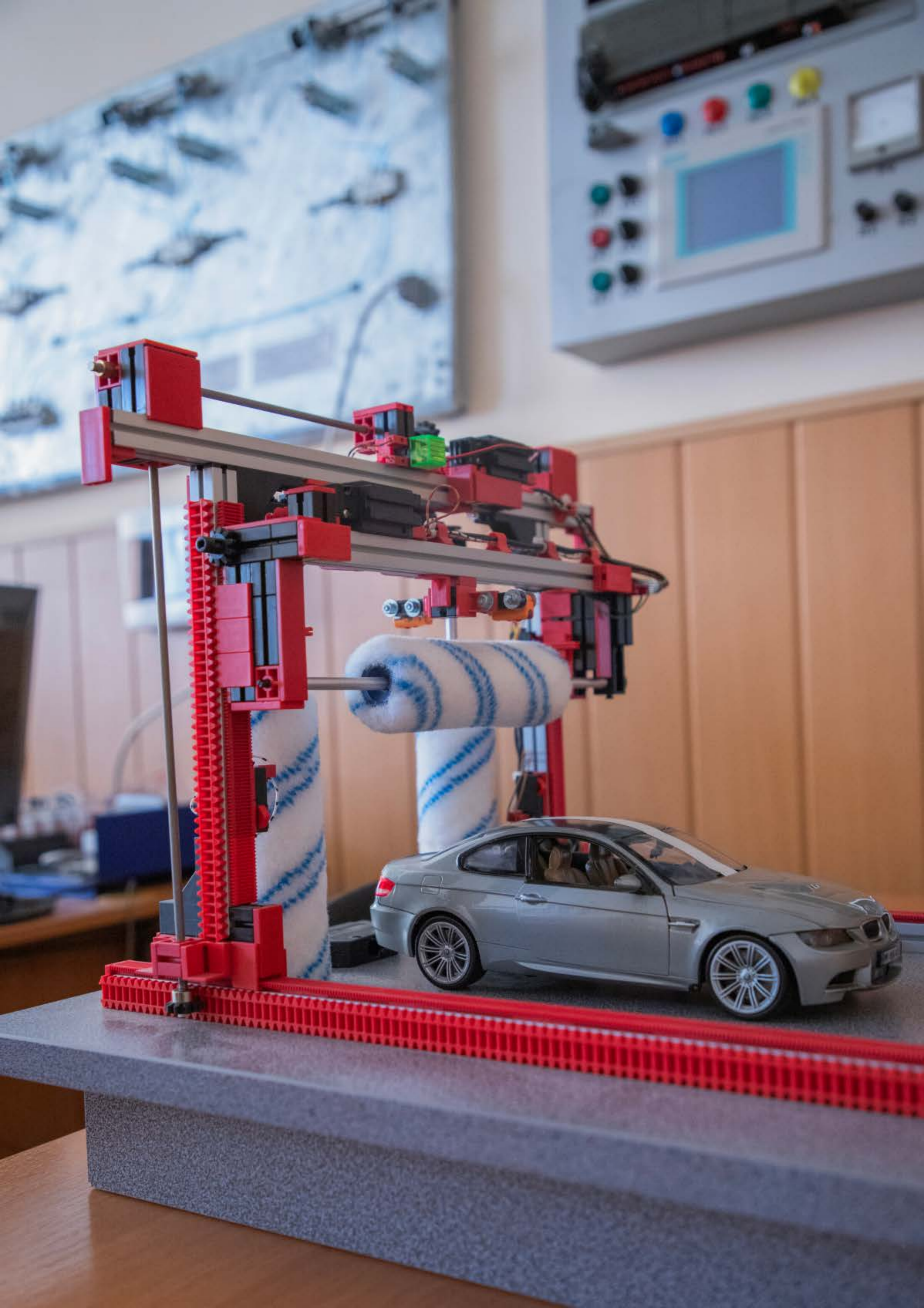
First-year students are actively working on the programs for recovery and sustainability of the Ukrainian energy system and modernise enterprises by automating them and implementing cyber-physical systems.

Pilz equipment allows for high-quality training of engineers by studying such educational components as Machine Safety and gaining practical programming skills for PNOZmulti safety controllers.

## Siemens Computer Laboratory

The laboratory is equipped with stands based on modern equipment from Siemens (Germany), Festo (Germany), and Microl (Ukraine), designed to automate the industrial technological processes. The stands feature such elements of mechatronic systems as: industrial controllers, intelligent relays, frequency converters, human-machine interface devices, pneumatic cylinders and distributors, microcontrollers, and relay-contact logic units.

The laboratory is designed to provide students with practical skills in working with modern industrial equipment and study microprocessor control systems.



# Testing and Diagnostics of Automobiles

The technical equipment complex of the laboratory consists of specialised stands for analysing performance characteristics of automobile tires, parameters of work processes in the automobile brake system with hydraulic drive, in the hydraulic amplifier of the steering mechanism system, making diagnostics of static and dynamic wheel imbalance, and installation angles of the car wheels.

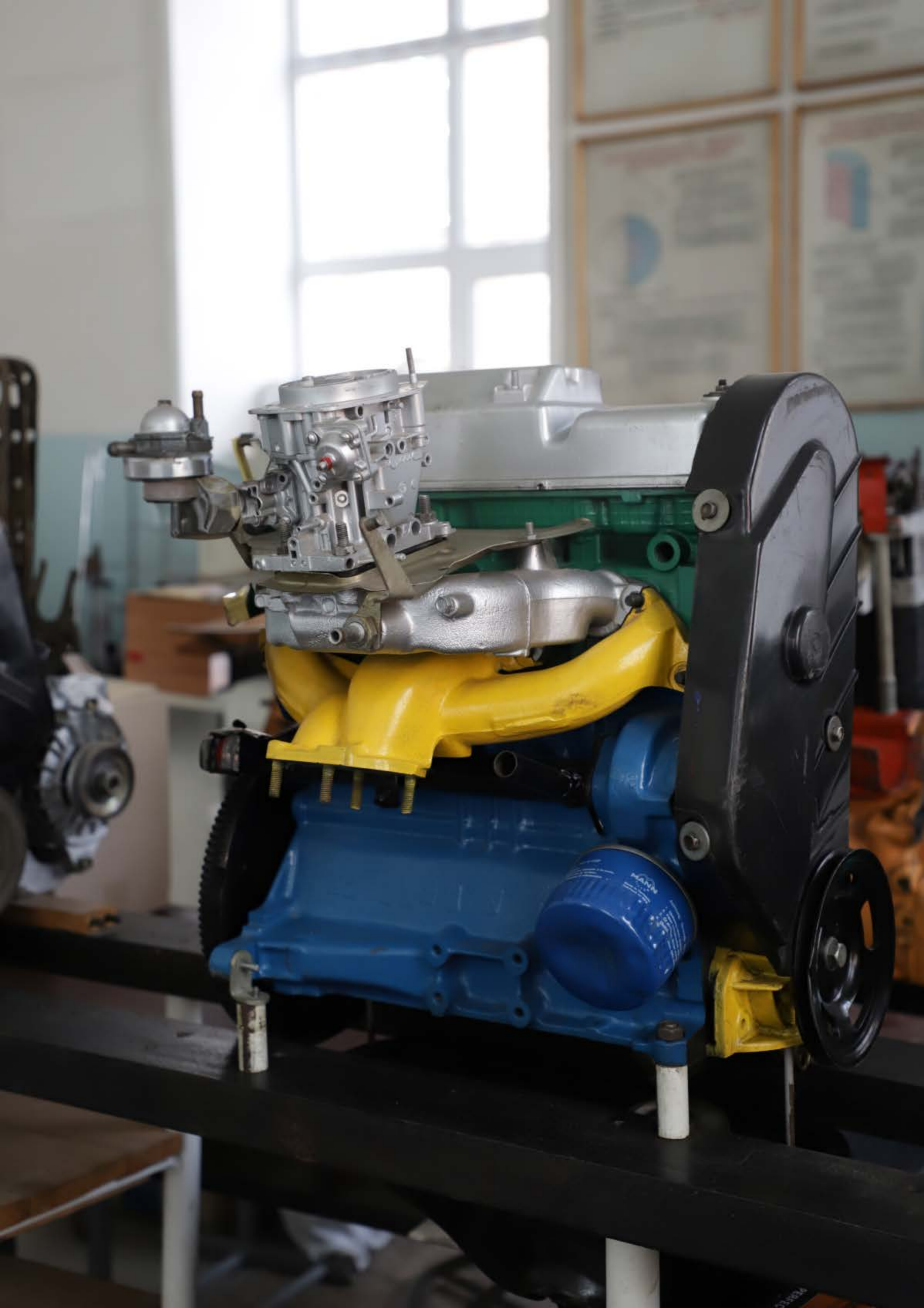
The laboratory is used to conduct training sessions to study the operational properties of modern cars and diagnose their technical condition, as well as to carry out research aimed at improving the reliability and durability of car components, assemblies and systems.

# Heat Engines and Heat Engineering

Experimental studies of load and speed characteristics of heat engines of various designs (two- and four-stroke piston gasoline, diesel, gas engines, rotary piston engines, engines with external heat supply) used as power plants for vehicles and special equipment are carried out on the basis of the laboratory's technical equipment.

The scientific research involving the laboratory equipment is aimed at increasing the efficiency of thermal and gas-dynamic processes in thermal engines in order to increase their fuel efficiency and environmental friendliness.





# Business Incubator

Students of National University “Zaporizhzhia Polytechnic” and youth from the city and region who have a knack for entrepreneurship, and who are eager to start their own business, and implement their business projects, often struggle to succeed in small and medium-sized businesses due to lack of experience and understanding of the basic principles of development strategy.

Within the paradigm of the business incubator, entrepreneurs who have recently started their businesses are provided with consultations by qualified specialists and experts systematically for the first two years of their activity.

The activity of the business incubator is based on involving the youth of the region in creating their own businesses and developing the economy of Zaporizhzhia region.

# Journalism Laboratory

The educational laboratory of journalistic proficiency is set up with modern equipment.

It is used to hold such events as training sessions, workshops, and classes in disciplines as follows: Agency Journalism, Radio Production, Newspaper and Magazine Production, Television Production, Internet Production. StudPol, a students’ newspaper, is published there. Creative meetings of students with leading experts in domestic and foreign journalism take place in the laboratory as well.



# Scientific Journals

Radio Electronics, Informatics,  
Management

WEB OF SCIENCE



New Materials and Technologies in  
Metallurgy and Mechanical Engineering



Electrical Engineering and  
Power Engineering



Change Management and  
Innovations



Entrepreneurship and Management  
of Social and Economic System Development



The university has a developed library-information system, which contains over 1 million hard copies, an electronic library comprising over 12,900 textbooks, books, lecture notes, articles, methodological guidelines, and dissertation abstracts in e-format, 80% of which are studies conducted by university teachers and researchers. There is a virtual reference, repository, and an electronic catalogue.

The Scientific Library of National University "Zaporizhzhia Polytechnic" provides free access to the most famous full-text electronic information databases in Ukraine and the world.

The logo for Scopus, featuring the word "Scopus" in a bold, orange, sans-serif font with a registered trademark symbol.The logo for EBSCO, consisting of the word "EBSCO" in white, bold, sans-serif capital letters inside a dark blue rounded rectangle.The logo for CulOnline, with "CulOnline" in a bold, black, sans-serif font.The logo for Web of Science, with the words "WEB OF SCIENCE" in white, sans-serif capital letters inside an orange rounded rectangle.The logo for БУДСТАНДАРТ Сервис Документов Online, with "БУДСТАНДАРТ" in red, "Сервис Документов" in smaller red text below it, and "Online" in a black script font to the right.The logo for Google Scholar, featuring a stylized "G" with a graduation cap on top, followed by the words "Google Scholar" in a colorful, sans-serif font.The logo for Springer Nature, with "SPRINGER" in blue, bold, sans-serif capital letters above "NATURE" in red, bold, sans-serif capital letters.The logo for Moodle, with a graduation cap icon above the word "moodle" in a bold, orange, lowercase sans-serif font.

Moodle serves as a course management system. It is used to organise traditional distance courses and certification of the seekers of higher education.

# International activities

Thirteen faculties of National University "Zaporizhzhia Polytechnic" provide educational services to foreign citizens.

The university has a pre-entry training department for foreign citizens, which was founded in 1991.





# Partner countries

In order to integrate National University "Zaporizhzhia Polytechnic" into the European Education and Research Area, to popularise the university among industrial enterprises, organisations, educational and research institutions, as well as to find foreign partners for cooperation, Zaporizhzhia Polytechnic establishes relations with international organisations, leading higher education institutions, and research centres.

**The university already cooperates with the following countries:**

Azerbaijan  
Albania  
Belgium  
Bulgaria  
Great Britain  
Armenia  
Greece  
Georgia  
Spain  
Kazakhstan

Moldova  
Germany  
Poland  
Romania  
Serbia  
Slovakia  
Turkey  
Uzbekistan  
Czech Republic  
Sweden





## INTERNATIONAL ACTIVITIES

Every year, more than 100 students are trained, have practical trainee courses and internships in the field of their study at foreign higher education institutions and international organisations.



# International competitive educational programmes



Within the framework of the Erasmus+ (KA1), the university has signed inter-institutional agreements with European universities, in particular with Catholic University of Leuven (Belgium), Ilmenau Technical University (Germany), Dortmund University of Applied Sciences and Arts (Germany), Thomas More University College (Belgium), Polytechnic of Madrid (Spain), University of Transylvania in Brasov, and University of Porto (Portugal).

This allows students to study for 3 to 6 months at a partner university, and for teachers to share their experience and scientific achievements.

# International projects

Cross-domain Competences for Healthy and Safe Work in the 21st Century (WORK4CE), an Erasmus + (KA2) programme project

Energy Efficiency and Energy Security Project, which provides equipping the university's infrastructure with cogeneration plants, jointly with USAID

Cybersecurity of Ukraine's Critical Infrastructure, a project of the US Agency for International Development (USAID)

Capacity Development in Physical Sciences and Engineering, a grant project from Research England, on behalf of UK Research and Innovation (UKRI)

Electrical Engineering Subjects for Ukrainian Universities, an international project

DILLUGIS (Digital Labs and Lectures for Ukrainian, German and International Students), an international project implemented with the East Bavarian University (Amberg-Weiden, Germany)

Virtual Master of Data Science Collaboration (ViMaCs), a grant project from the German Academic Exchange Service DAAD

EuroPIM Virtual Master School Ukraine (EU-ViMUK), a project supported by DAAD, the German Academic Exchange Service

## INTERNATIONAL ACTIVITIES

Zaporizhzhia Polytechnic not only expands the range of partners, but also builds a reliable and long-term co-operation. We honourably represent Ukraine in the international educational and scientific arena

a Full Member of the European Association of Higher Education Institutions



a Full Member of the European Association of Institutions in Higher Specialised Education



a Full Member of the Great Charter of Universities



an active participant of the Twinning Programme – cooperates with Cardiff University



a Chairmanship of the Azov-Black Sea Universities Association



# BEST Zaporizhzhia

The organisation unites students, provides them with the opportunity to participate in summer educational courses, training sessions, seminars, fairs, and engineering competitions, as well as to travel around Europe.

In 2007 the initiative group of university students, BEST board members, was admitted to the European Union of Students of Higher Technical Education Institutions (BEST).

Every year BEST holds international academic courses on the premises of National University "Zaporizhzhia Polytechnic". They cover technical topics and engage students of European universities.

## BEST international projects



# Student Life

**Bright, interesting, and diverse – this is all about student life at “Zaporizhzhia Polytechnic”!**

The university has powerful student associations: Student Self-government and the Primary Trade Union Organization of students, postgraduates, and doctoral students of the National University “Zaporizhzhia Polytechnic”, the latter being the largest student trade union in Zaporizhzhia region.



## STUDENT LIFE

Every student of the university is a member of a large family, where one has an opportunity to become not only a specialist in the chosen field but also a public figure, a scientist, a youth opinion leader, or a cultural activist.



Soft skills



Critical thinking



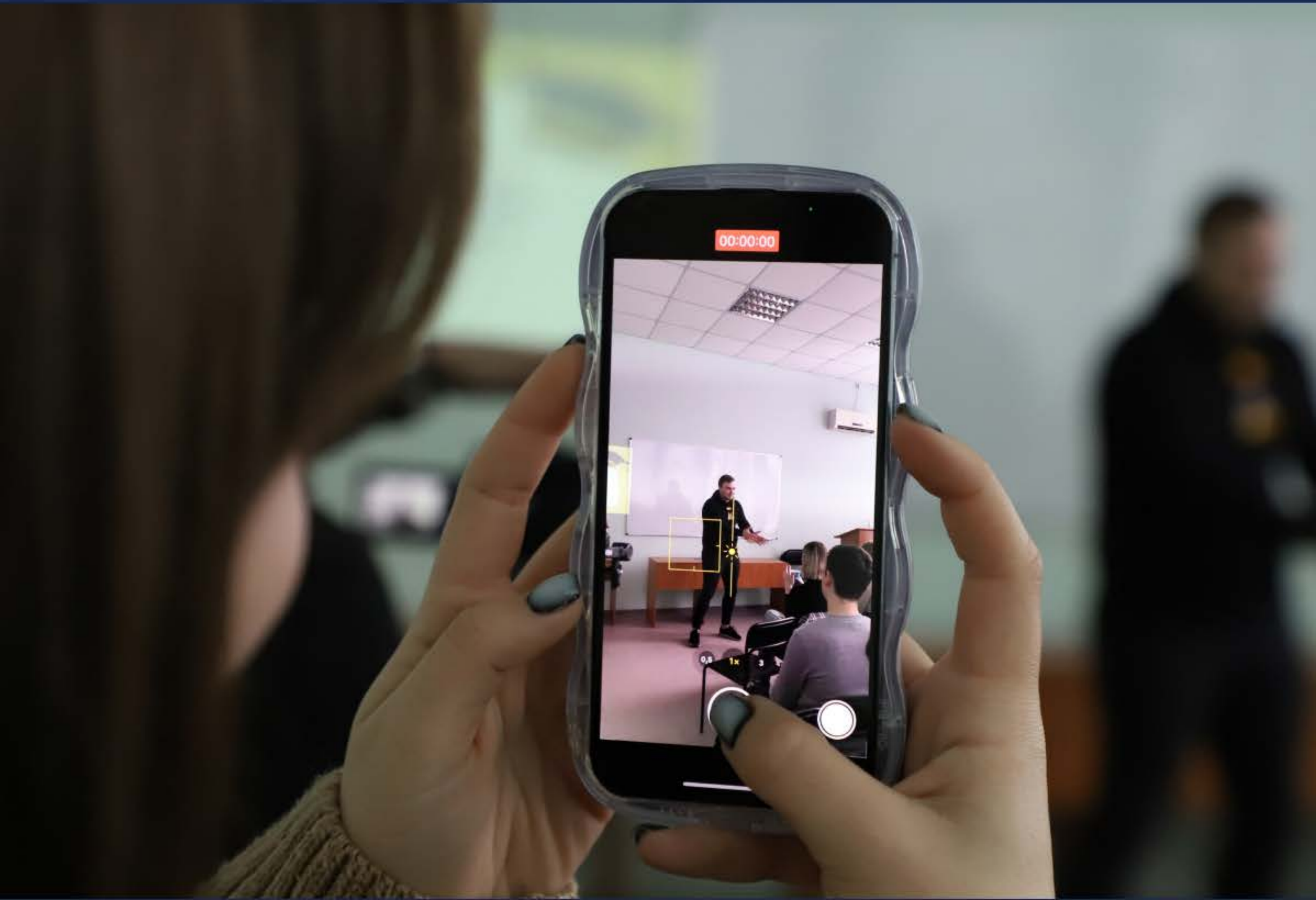
Organisational skills



Teamwork



Public speaking skills



## STUDENT LIFE

Representatives of student youth actively participate in the university management. They are part of the Rector's Council, the Academic Council, the university staff conference, scholarship commissions, and working groups to address university life issues.



Social activity  
of students



Social and legal  
protection of students





# Partnerships

Representatives of student self-government actively expand cooperation horizons: our students participate in the organisation and holding student conferences, volunteer projects, and cultural events not only at the university and city level but also in the European space, in cooperation with progressive student organisations of the University of Alicante (Spain), Cardiff University, and the University of York (the United Kingdom).

In the framework of cooperation with international organisations, students have united to hold joint events to improve their language skills, information meetings to share experiences and organise academic mobility.



# Activities

The daily activities of student organisations include holding competitions, concerts, festivals, open-air parties, shows, and sports events that will not let a student get bored. They are: Rector's Cup in mini-football, movie nights, Speaking Club, educational projects by BEST, the non-profit volunteer international organisation, etc. Recreation and healthcare programs are also implemented.



## STUDENT LIFE

Studying at “Zaporizhzhia Polytechnic” is an opportunity for sports talent development.

Among our students there are European and world champions, winners of competitions in sports aerobics, boxing, swimming, athletics, football, handball, basketball.

Students of our university are bronze medalists of the Ukrainian Handball Championship and winners of the Student Basketball League, champions, prize-winners, and participants of the Olympic, Paralympic, and World Games, European and World championships.

At the university, you can engage in such individual sports as boxing, diving, swimming, and wrestling.

We are the only higher education institution in Zaporizhzhia and the region that has a full-profile shooting range and develops such a topical sport as shooting.

We are also proud of our girls, who make up 2/3 of the main squad of the Ukrainian national team in sports aerobics and are silver medalists of the World Championship.



National University “Zaporizhzhia Polytechnic” is a multidisciplinary higher education institution that prepares specialists for work in a wide range of fields of knowledge and specialties, focusing on the standards of higher education, modern scientific achievements, and educational traditions of Ukraine and the European educational space.

**Years of experience in training professionals!**



ЗАПОРІЗЬКА ПОЛІТЕХНІКА





zp.edu.ua

Promote development  
Zaporizhzhia Polytechnic

