

Consolidated Report

**Project:** Digital transformation of HEIs education process in Ukraine and Moldova for sustainable engagement with enterprises, DIGITRANS

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# Ex Ante Evaluation Report

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*DIGITRANS Consolidated Report*

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## SUMMARY OF THE REPORT

The Ex-Ante report is a description of existing study programmes and current situation at partner universities and the motivation – necessity for curricula development and modernisation. Higher education institutions from Ukraine and Moldova, participants in the project, have each prepared a description of the education system as well as the system of accreditation and evaluation of curricula and courses implemented in their countries.

The same report includes:

- A description of the undergraduate, postgraduate and doctoral programs of each institution and presentation of the proposed modifications or additions to them. The new curricula proposed within the framework of the program are also presented. Both the proposed modifications or additions to the existing curricula and the new proposed programs indicate the reasons that led to them.
- Presentation of double degree programmes between European universities and universities in Ukraine or Moldova.
- A recording of the existing laboratory and computing infrastructures that will potentially be integrated into the project under development within the framework of its digital learning ecosystem.
- Discussion of possible obstacles to certification and then to the implementation of the proposed programs in order to study and take timely the necessary measures to address them, if they arise.
- Presentation of the motivations and opportunities that lead the partners to participate and implement the project.

Finally, a brief review of the individual reports and discussion of the findings of the attempted recording is presented.



## 1. Chernihiv National Technological University, CPNU

### 1.1 Summary

The DIGITRANS project aims to increase graduates' employability, support sustainable growth and jobs at Ukraine and Moldova, in line with the Green and Digital transition, through implementation of supporting measures such as:

- Integration of research and training in such a way that students have the opportunity to conduct research at partner universities and enterprises. Introduction of integrated thematic complexes that will give students the opportunity to achieve additional learning outcomes.

- Development of innovative educational programs of electrical engineering, information and computer systems, cybersecurity, automatic control engineering, electrical and electronic equipment, engineering and management in road transport, electro mobiles, automotive manufacturing, as well as necessary competences of transversal skills and entrepreneurship knowledge aligned with the Green Deal and Fit for 55 EU strategic aims.

- Development and implementation of Double Diploma programs between EU and Ukrainian, Moldavian universities.

- Introduction of innovative practical training schemes in conjunction with relevant industrial partners, e.g., internship, professional courses at enterprises, etc.

- Digitalization of education with practical training of students in specific skills with increasing demand in the job market, e.g. specific software for diagnostics, repair and maintenance of a modern type of transport, etc.

- Development of virtual and remote practice (labs), e.g. classes for modelling, simulation, building and debugging models, etc.

- Developing and/or sharing Remote Experiment Environment as a digital distributed educational infrastructure supporting the Digital Learning Ecosystem.

- Developing an open interface for interconnection of Digital Learning Ecosystem and e-learning platforms of partners universities to the forthcoming Open University Platform in Ukraine.

- Providing an opportunity to academic staff and students fleeing from Ukraine or internally displaced as refugees to be involved in an education process through the Digital Learning Ecosystem of DIGITRANS.

### 1.2 Brief Description of the Educational System

**Ukraine** is an independent state located in the southeastern part of Europe, washed by the Black and Azov seas. It is the largest country that lies entirely in Europe. In addition, the geographical center of Europe is located on the territory of Ukraine - not far from the city of Rakhov, Zakarpattia region.

The capital of Ukraine is the hero city of Kyiv, which is also the country's largest city and one of the oldest cities in Europe. Kharkiv, Dnipro, Donetsk, Odesa, and Lviv are also among the largest cities of our country.

The state language is Ukrainian, and the national currency is the hryvnia.



The time of the second time zone UTC+2 is valid throughout the territory of Ukraine. The climate is moderate, the temperature changes insignificantly in summer and winter, reaching maximum values in July and minimum values in January.

Ukraine is an industrial-agrarian country with a predominance of raw material production. One of the leading branches of the country's economy is agriculture. The country is rich in unique Ukrainian chernozems. They were formed under steppe vegetation in a climate that, unlike the steppes of Eurasia, is milder and more humid, due to the influence of the Atlantic and southern seas.

Other leading sectors of the economy: electricity, coal, fuel, oil and gas industry.

**Higher education** (according to the Law of Ukraine dated 01.07.2014 No. 1556-VII "On Higher Education") - a set of systematized knowledge, skills and practical skills, ways of thinking, professional, worldview and civic qualities, moral and ethical values, other competences acquired in a higher educational institution (scientific institution) in the relevant field of knowledge for a certain qualification at the levels of higher education, which in terms of complexity are higher than the level of full general secondary education

The structure of higher education in Ukraine is determined in accordance with the Law of Ukraine dated July 1, 2014 No. 1556-VII "On Higher Education".

#### **Levels of higher education in Ukraine**

Specialists with higher education are trained according to the relevant educational-professional, educational-scientific, scientific programs at the following levels of higher education:

- initial level (short cycle) of higher education;
- first (bachelor) level;
- second (master's) level;
- third (educational and scientific) level;
- scientific level.

Obtaining a higher education at each level of higher education requires a person to successfully complete the corresponding educational (educational-professional or educational-scientific) or scientific program, which is the basis for awarding the corresponding degree of higher education:

- junior bachelor;
- bachelor;
- master's degree;
- doctor of philosophy;
- Doctor of Science.

**A junior bachelor** is an educational and professional degree obtained at the initial level (short cycle) of higher education and awarded by a higher educational institution as a result of successful completion by the student of higher education of an educational and professional program, the volume of which is **90-120 ECTS\* credits**.

A person has the right to obtain a junior bachelor's degree, provided that he has a complete general secondary education.

**A Bachelor's degree** is an educational degree obtained at the first level of higher education and awarded by a higher educational institution as a result of successful completion of an educational and professional program by the student of higher education,



the volume of which is **180-240 ECTS credits**. The scope of the educational and professional program for obtaining a bachelor's degree based on the junior bachelor's degree is determined by <sup>1</sup>the higher educational institution.

A person has the right to obtain a bachelor's degree, provided that he has a complete general secondary education.

**A master's degree** is an educational degree obtained at the second level of higher education and awarded by a higher educational institution (scientific institution) as a result of successful completion of the relevant educational program by the student of higher education. A master's degree is obtained by an educational-professional or an educational-scientific program. The volume of the educational and professional master's training program is **90-120 ECTS credits**, the volume of the educational and scientific program is 120 ECTS credits. The master's educational and scientific program necessarily includes a research (scientific) component of at least 30 percent.

A person has the right to obtain a master's degree, provided that he has a bachelor's degree.

**Doctor of Philosophy** is an educational and at the same time the first scientific degree obtained at the third level of higher education on the basis of a master's degree. The degree of Doctor of Philosophy is awarded by the specialized academic council of a higher educational institution or scientific institution as a result of successful completion of the relevant educational and scientific program by the student of higher education and the public defense of the dissertation in the specialized academic council.

A person has the right to obtain the degree of Doctor of Philosophy while studying at a graduate school (adjunct). Persons who professionally carry out scientific, scientific-technical or scientific-pedagogical activities at their main place of work have the right to obtain the degree of Doctor of Philosophy outside of postgraduate studies, in particular during a creative leave, provided they successfully complete the relevant educational and scientific program and publicly defend their dissertation in the specialized scientific council.

The standard period of training for a doctor of philosophy in post-graduate studies (adjunct) is four years. The volume of the educational component of the educational and scientific program for the preparation of a doctor of philosophy is **30-60 ECTS credits**.

**Doctor of Science** is the second scientific degree obtained by a person at the scientific level of higher education on the basis of the Doctor of Philosophy degree and involves the acquisition of the highest competencies in the field of development and implementation of research methodology, conducting original research, obtaining scientific results that provide the solution of an important theoretical or applied problem, have national or world significance and are published in scientific publications.

The degree of Doctor of Sciences is awarded by a specialized academic council of a higher educational institution or scientific institution based on the results of a public defense of scientific achievements in the form of a dissertation or a published monograph, or based on a set of articles published in domestic and international peer-reviewed professional

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\* **ECTS** - European credit and transfer system. The volume of one ECTS credit is 30 hours. The workload of one academic year in the full-time form of education is, as a rule, 60 ECTS credits.





publications, the list of which is approved by the central executive authority in the field of education and science.

### **1.3 Accreditation System**

**Accreditation of educational programs** in the system of higher education in Ukraine is carried out in accordance with the Laws of Ukraine "On Education", "On Higher Education", the statute of the National Agency for Quality Assurance of Higher Education (National Agency) and the **Regulations on the Accreditation of Educational Programs, according to which the training of students of higher education is carried out of education** (Approved order of the Ministry of Education and Science of Ukraine dated July 11, 2019 No. 977) (hereinafter - REGULATIONS).

Accreditation is carried out at the initiative of the educational institution and is carried out by the National Agency.

**The purpose of accreditation is:**

- 1) confirmation of compliance of the educational program and educational activities under this program with the criteria defined by these Regulations;
- 2) provision of recommendations and consultations to educational institutions regarding the improvement of the educational program and educational activities under this program;
- 3) providing all interested parties with information about the educational program, educational activities under this program (including scientific achievements), the effectiveness of processes and procedures for internal quality assurance of higher education under the educational program;
- 4) strengthening of trust in higher education in Ukraine;
- 5) promoting the integration of Ukrainian educational institutions into the European Higher Education Area.

Accreditation of the educational program is carried out in accordance with the criteria for evaluating the quality of the educational program listed in the appendix to the REGULATIONS (hereinafter referred to as the Criteria).

Standards and recommendations for quality assurance in the European area of higher education and recommendations provided by the National Agency can be used to apply and clarify the Criteria.

The criteria are used by the educational institution for the preparation of information on self-assessment, as well as by the National Agency, its industry expert councils (hereinafter - GER) and experts during accreditation.

Evaluation of the educational program and educational activities under this program is carried out according to each Criterion according to the rating scale, which covers four levels of compliance:

- **level "F"** - the educational program and/or educational activities under this program do not meet the defined Criterion, and the identified deficiencies are of a fundamental nature and/or cannot be eliminated within one year;
- **level "E"** - the educational program and/or educational activities under this program do not fully meet the defined Criterion, and the identified deficiencies can be eliminated within one year;



- **level "B"** - the educational program and educational activities under this program fully meet the defined Criterion or generally meet the defined Criterion with shortcomings that are not significant;
- **level "A"** - the educational program and educational activities under this program fully meet the defined Criterion, and also have an innovative/exemplary character.

Accreditation is carried out for the first time during the last or penultimate year of study of the first set of education seekers under a certain educational program.

The next (regular) accreditation is carried out during the last year of validity of the certificate of accreditation of the relevant educational program. If an educational institution applies for accreditation after the expiry of the relevant certificate, such accreditation is considered accreditation for the first time.

The educational institution has the right to prematurely initiate the next (regular) accreditation.

During one academic year, an educational institution has the right to apply for accreditation of one educational program only once.

The accreditation certificate is issued for the first time for a period of five years, and during the second and subsequent accreditations - for a period of 10 years. The validity period of the decision on conditional (delayed) accreditation is 1 year.

The next (regular) accreditation is carried out during the last year of validity of the accreditation certificate.

Certificates of accreditation of educational programs issued by foreign accreditation agencies or higher education quality assurance agencies, the list of which is approved by the Cabinet of Ministers of Ukraine, are recognized in Ukraine.

During of DIGITRANS project three educational programs of CPNU will be updated by way of developing new and upgrading exist courses:

- "Computer engineering" (bachelor's level) - specialty accreditation certificate, the validity period of the certificate has been extended until 01.07.2025;
- "Telecommunications and radio engineering" (bachelor's level) - the validity period of the certificate of accreditation of the educational program is until 01.07.2027;
- "Telecommunications and radio engineering" (master's level) - validity of the certificate of accreditation until 01.07.2026;
- Electronics of robotic systems and complexes (bachelor's level) - the specialty accreditation certificate has been extended until 01.07.2025.

According to the "PROCEDURE for developing, approving, monitoring and closing educational programs at Chernihiv Polytechnic National University" the educational program is developed by the project group, which is formed and approved by order of the rector of the University separately for each educational program. The head of the project group - the guarantor of the educational program - is responsible for the implementation of the educational program. The guarantor of the educational program can only be a full-time scientific-pedagogical or scientific employee of the University.

- The development and approval of educational programs involves the following actions:
  - Planning and organizing the work of the project group.
  - Acquaintance with the standard of higher education for a certain specialty



- Formulation of expected learning outcomes
- Development of components of the educational program (profile, list of components, form of attestation of applicants, matrix of correspondence of program competences, matrix of provision of program learning outcomes)
- Verification and coordination of the educational program by the educational department and the department of methodical work, accreditation and licensing
- Coordinating with stakeholders and (or) reviewing the educational program
- Approval of the educational program by the academic council of the University
- Posting information about the educational program for public access on the University's official web resources.
- Monitoring and periodic review of the educational program is carried out by stakeholders, the guarantor of the educational program and the University management by analyzing the effectiveness of its further implementation in an unchanged form. At the same time, the following are considered:
  - Acceptance or adjustment of the standard of higher education
  - Conclusions of the accreditation examination
  - Feedback from stakeholders
  - Review of the University's mission and strategy
  - Results of scientific research
  - Results of the introductory campaign.

#### **1.4 Structure of BSc, MSc and PhD programs**

According to **Regulations on the Accreditation of Educational Programs, according to which the training of students of higher education is carried out of education**, the educational program should have clearly formulated goals that correspond to the mission and strategy of the higher education institution. The goals of the educational program and program learning outcomes are determined considering the positions and needs of interested parties and trends in the development of the specialty, the labor market, the industry and regional context, as well as the experience of similar domestic and foreign educational programs. The educational program should provide an opportunity to achieve learning outcomes defined by the standard of higher education for the relevant specialty and level of higher education.

The scope of the educational program and individual educational components (in credits of the European Credit Transfer and Accumulation System) meets the requirements of the legislation regarding the educational load for the corresponding level of higher education.

The content of the educational program must have a clear structure and correspond to the subject area of the specialty determined for it. The educational components included in the educational program constitute a logical interconnected system and together make it possible to achieve the stated goals and program learning outcomes. The educational program and curriculum provide for practical training of students of higher education, which provides an opportunity to acquire the competencies needed for further professional activities, and acquisition of social skills (soft skills) corresponding to the stated goals by students of higher education.



According to the “PROCEDURE for developing, approving, monitoring and closing educational programs at Chernihiv Polytechnic National University” the educational program is developed by the project group, which is formed and approved by order of the rector of the University separately for each educational program. The head of the project group - the guarantor of the educational program - is responsible for the implementation of the educational program. The guarantor of the educational program can only be a full-time scientific-pedagogical or scientific employee of the University.

The development and approval of educational programs involves the following actions:

- Planning and organizing the work of the project group.
- Acquaintance with the standard of higher education for a certain specialty
- Formulation of expected learning outcomes
- Development of components of the educational program (profile, list of components, form of attestation of applicants, matrix of correspondence of program competences, matrix of provision of program learning outcomes)
- Verification and coordination of the educational program by the educational department and the department of methodical work, accreditation and licensing
- Coordinating with stakeholders and (or) reviewing the educational program
- Approval of the educational program by the academic council of the University
- Posting information about the educational program for public access on the University's official web resources.

Monitoring and periodic review of the educational program is carried out by stakeholders, the guarantor of the educational program and the University management by analyzing the effectiveness of its further implementation in an unchanged form. At the same time, the following are considered:

- Acceptance or adjustment of the standard of higher education
- Conclusions of the accreditation examination
- Feedback from stakeholders
- Review of the University's mission and strategy
- Results of scientific research
- Results of the introductory campaign.

According to “Recommendations for the development of educational programs for scientific and pedagogical workers at the Chernihiv Polytechnic National University "Educational programs. Construction, presentation, design and content" the structure of the educational program, as a rule, has the following components:

- Title page
- Letter of approval
- Preface
- Profile of the educational program
- General information
- The purpose of the educational program
- Characteristics of the educational program
- Graduates' suitability for employment and further education
- Teaching and assessment
- Software competencies
- Program learning outcomes



- Resource support for program implementation
- Academic mobility
- List of components of the educational and professional program and their logical sequence
- Structural and logical diagram
- Attestation form
- Matrix of correspondence of program competencies to the components of the educational program
- Matrix of provision of program learning outcomes with relevant components of the educational program
- List of regulatory documents on which the educational program is based.

### **1.5 Existing Study Programs**

In DIGITRANS project the based study programs of CPNU are:

- “Computer engineering” (bachelor's level) - specialty accreditation certificate, the validity period of the certificate has been extended until 01.07.2025;
- “Telecommunications and radio engineering” (bachelor's level) - the validity period of the certificate of accreditation of the educational program is until 01.07.2027;
- “Telecommunications and radio engineering” (master’s level) - validity of the certificate of accreditation until 01.07.2026;
- “Electronics of robotic systems and complexes” (bachelor's level) - the specialty accreditation certificate has been extended until 01.07.2025.

1. “Computer Engineering” for the bachelor level of higher education in the specialty 123 "Computer engineering". Qualification: Bachelor of Computer Engineering.

Integrated competence:

- design, modeling, implementation and testing of the computer systems;
- demonstrate the achievement of learning outcomes determined by this educational program;
- ability to logically, on the basis of modern scientific methods justify the choice of hardware and software to solve the engineering tasks.

Mandatory courses: 156 credits of ECTS.

Elective courses: 66 credits of ECTS.

Practical training: 18 credits of ECTS.

Total volume of the educational program: 240 credits of ECTS.

2. “Telecommunications and radio engineering” for the the first level of higher education in specialty 172 "Telecommunications and radio engineering". Qualification: Bachelor of Telecommunications and radio engineering.

Integrated competence:

- creation and maintenance of the functioning of telecommunication and radio technical devices, systems and complexes for processing, storage and exchange of information at a distance;
- control and management of machines, mechanisms and technological processes in radio-electronic, medical equipment, measuring devices and systems, as well as means of designing;



- modeling, experimental processing, preparation for production and maintenance of such telecommunication and radio technical devices, systems and IT complexes.

Mandatory courses: 180 credits of ECTS.

Elective courses: 60 credits of ECTS.

Total volume of the educational program: 240 credits of ECTS.

3. "Telecommunications and radio engineering" for the the second level of higher education in specialty 172 "Telecommunications and radio engineering". Qualification: Master of Telecommunications and radio engineering.

Integrated competence:

- solving the complex specialized tasks and practical problems in the field of professional activity in telecommunications and radio engineering or in the learning process, which involves the application of theories and methods of this subject area;
- conducting research and/or implementing innovations and is characterized by the complexity and uncertainty of conditions and requirements.

Mandatory courses: 65 credits of ECTS.

Elective courses: 25 credits of ECTS.

Total volume of the educational program: 90 credits of ECTS.

4. "Electronics of robotic systems and complexes" for the the first level of higher education in specialty 171 Electronics. Qualification: Bachelor of Electronics.

Integrated competence:

- solving the complex specialized tasks and practical problems, characterized by complexity and uncertainty of conditions, during professional activities in the field of electronics, or in the learning process, which involves the application of theories and methods of electronics.

Mandatory courses: 180 credits of ECTS.

Elective courses: 60 credits of ECTS.

Total volume of the educational program: 240 credits of ECTS.

### **1.5.1 Proposed modifications / additions**

During DIGITRANS project CPNU plans to develop 3 new courses and to update 3 courses as it is shown in table below:





|   | <b>Study program/ Course /Lab title</b>                             | <b>Updated or new</b> | <b>Level: Bachelor, Master, other</b> | <b>ECTS credit points</b> | <b>Mandatory or elected course</b> |
|---|---|-----------------------|---------------------------------------|---------------------------|------------------------------------|
|   | <i>Study program "Computer Engineering":</i>                        |                       |                                       |                           |                                    |
| 1 | Microcontroller Systems Programming                                 | new                   | <b>Bachelor</b>                       | 6                         | <b>elected</b>                     |
| 2 | Systems on Chip   | new                   | <b>Bachelor</b>                       | 4                         | <b>elected</b>                     |
| 3 | Design of Digital Devices   | new                   | <b>Bachelor</b>                       | 5                         | <b>Mandatory</b>                   |
|   | <i>Study program "Telecommunications and Radio Engineering":</i>    |                       |                                       |                           |                                    |
| 4 | Electrical Circuit Design   | update d              | <b>Bachelor</b>                       | 12                        | <b>Mandatory</b>                   |
| 5 | Digital Systems of Telecommunications                               | update d              | <b>Master</b>                         | 5                         | <b>Mandatory</b>                   |
| 6 | <i>Study program "Electronics of robotic systems and complexes"</i> |                       |                                       |                           |                                    |
|   | Digital electronics devices   | update d              | <b>Bachelor</b>                       | 11                        | <b>Mandatory</b>                   |
|   | <b>Total</b>  |                       |                                       | <b>43</b>                 |                                    |

### 1.5.2 Justification of proposed modifications / additions

The need to modify educational programs is justified both by the general trend in the development of digitalization in Ukraine and by the needs of the CPNU in this direction.

General trend is related to the fact that in 2022, Ukraine joined the Digital Europe Program until 2027. At the meeting of the Ukraine-EU Association Council held on September 5, 2022 in Brussels, where Ukraine took part as a candidate for membership in the European Union, Ukraine's efforts in reconstruction and rapid development in the direction of green, climate-resistant, IT and telecommunications services were highly appreciated.

Such trends pose a certain challenge to the education system in Ukraine, which must not only provide all spheres of the economy with qualified specialists, but also itself needs digital improvement. These needs are growing by the consequences of the coronavirus pandemic and war actions initiated by Russia in Ukraine, which exacerbated the problem of development and mastery of technologies in the education system to ensure people's rights to quality education. Modern system of education and science in Ukraine must undergo fundamental digital changes and correspond to the global trends of digital development in order for every person to realize his potential. On this way, the Concept of digital transformation of education and science for period until 2027 includes three strategic goals that include a number of operational actions:

Strategic goal 1. "The digital educational environment is accessible and modern":

- Educational institutions are equipped with equipment for creating a digital educational environment;



- Educational institutions are provided with broadband Internet access.
- Strategic goal 2. "Employees in the field of education possess digital competences":
- Improvement of the qualifications of pedagogical and scientific-pedagogical employees of educational institutions for the development of digital competences is carried out regularly;
- Education standards for pedagogical specialties contain modern requirements for the formation of digital competences.

Strategic goal 3. "Educational content meets modern requirements":

- Educational programs in the field of ICT have been updated;
- Availability of accessible digital content to support education.

Achieving the above goals will be carried out taking in account the experience of advanced EU countries in improving the education system.

As for internal needs of the CPNU to change study program in direction of digitalization it is connected, at the first, with such university's strategic aims:

- Increasing the international authority of the University, ensuring compliance of educational services with international quality standards.
- Development of an effective management system of the University, modernization of its structure in accordance with changes in the national system of higher education and in the context of integration into the world space.
- Implementation of the latest information technologies and software in all spheres of the University's activities, integration of the University into the national and global information space.

The next needs are connected with the development of methodics and resources of student training in Educational and Scientific Institute of Electronic and Information Technologies of CPNU that includes:

- Creation of smart classrooms for educational classes, equipped with modern multimedia equipment and access to electronic resources.
- Creation of new experimental educational laboratories, including laboratories of virtual and augmented reality, internet marketing and others.
- Expansion of internship, retraining and professional development programs thanks to the use of e-learning technologies.

### ***1.6 Digital and labs resources for the integration into Digital Learning Ecosystem of DIGITRANS***

In CPNU the direction of Digital Transformation is supported by departments of Cybersecurity, Information and Computer Systems, Electronic and Mechatronics, Radio Engineering and Embedded Systems, which conduct training in Computer engineering, Electronic engineering and Radio Engineering on bachelors and master levels.

The training at these departments are provided by 6 professors and 32 PhD associate professors with a set of specialized labs including: Embedded systems lab, Renewable Energy Sources lab, Simulation of Cyber-Physical Systems lab, Cyber Security lab, Electrical Cars lab, VoIP technologies lab, Network technologies lab. The laboratories are equipped with



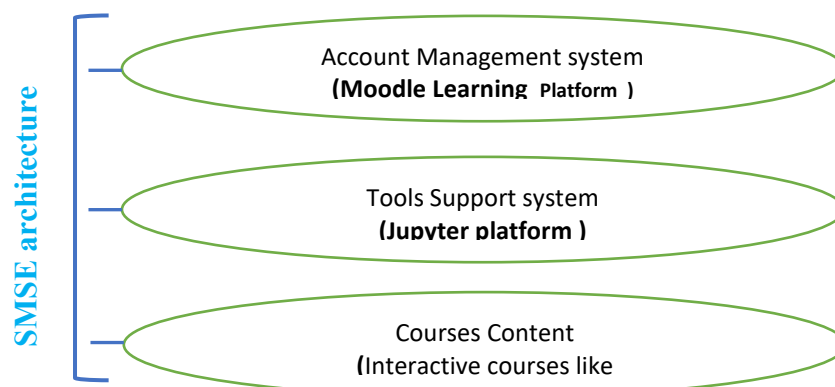


specialized computer equipment and software to ensure the implementation of the disciplines of the curriculum of the educational and professional program. The laboratories are equipped with modern personal computers and are connected to the local computer network of the CPNU and have access to the Internet using a wired Ethernet network and a wireless Wi-Fi network.

CPNU is a performer of a more than 20 R&D projects connected with digitalization direction at the regional and national levels. The university takes an active part in cooperation with regional, national and foreign academic organizations and companies including the National Academy of Science of Ukraine, SNT, Chernihiv IT-cluster, Microsoft, LabVIEW, B&R Industrial Automation, Wolfram and other. International activities of CPNU includes more than 50 agreements with foreign universities and organization, performed 5 Tempus IV, Eastern Partnership Territorial Cooperation, NATO and Erasmus+ projects, European Investment Bank program of priority activities on energy efficiency and EVZ foundation programs.

In 2022-2023, during the performing of Erasmus + project “Development of practice-oriented student-centered education in the field of modeling cyber-physical systems” (CybPhys) in CPNU was created a new Shared Modeling and Simulation Environment (SMSE) for educational purposes. Now, SMSE becomes the base of e-learning ecosystem for the practical modeling of cyber-physical systems for innovative physical, mathematical and engineering topics. The creation of the SMSE was based on the experience of using the Jupiter platform in educational and scientific fields including the use of Jupyter Notebooks in pedagogical practices, organization of computational cognitive science labs, teaching with Jupyter Notebook in the Web and creation of JupyterLab interface. As a further advancement of existing practices, SMSE was integrated with the learning management system Moodle, that widely used at university. It provided the new capabilities of the Jupyter platform to create virtual laboratories.

Architecture of SMSE includes three components, as it is shown on figure below.

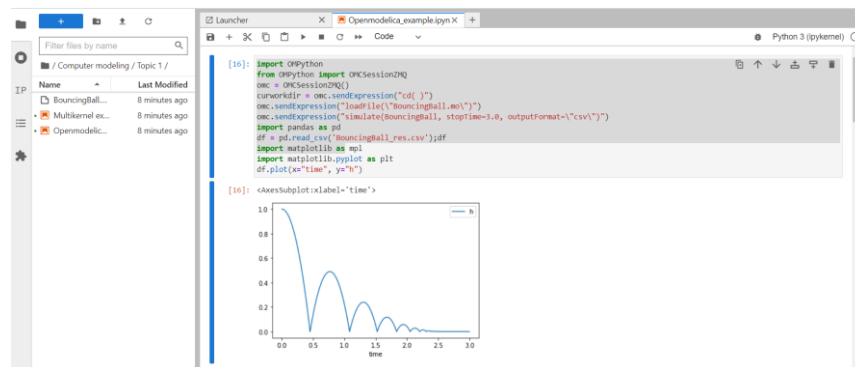


Account management system is represented by Moodle platform. Its main purpose, as name suggests, is authentication of existing accounts into Jupyter, while also fulfilling a role as an online learning platform. All course materials are to be developed by the teachers and uploaded into a Moodle course, which students can access. Such an approach would ensure consistency in access to both existing courses that do not use interactive lecture materials and such that rely on SMSE, while also providing a simple and streamlined workflow for implementing interactive lectures and assignments into legacy Moodle courses.



All course materials are to be developed by the teachers and uploaded into a Moodle course, which students can access. Such an approach would ensure consistency in access to both existing courses that do not use interactive lecture materials and such that rely on SMSE, while also providing a simple and streamlined workflow for implementing interactive lectures and assignments into legacy Moodle courses.

The main task of SMSE is to support in online mode the individual work of students with the course materials (lectures, practical or laboratory works) stored in Moodle. This possibility is provided by the use of remote laboratories with pre-installed software kernels that are created after running the virtual server related to a course. In SMSE, Jupyter Notebook documents are launched for execution on the JupyterLab virtual server, which runs the software kernels and provides additional tools for the execution of program code directly from Jupyter Notebook documents. Example of virtual user's lab with opened Jupyter Notebook documents is shown on figure below:



### 1.7 Motivation for project development

From the European experience the directions in DIGITRANS learning ecosystem implementation should include:

- creation of on-line virtual laboratories, video courses, remote testing, remote classes with the hardware equipments;
- the use of augmented & virtual reality in the process of practical training - the creation of training modules with elements of augmented and virtual reality;
- distributed use of electronic course materials and organization of access to them;
- support for remote presence in on-line mode (stable communication);
- formation and sharing of a distributed electronic educational infrastructure (or an educational digital ecosystem).

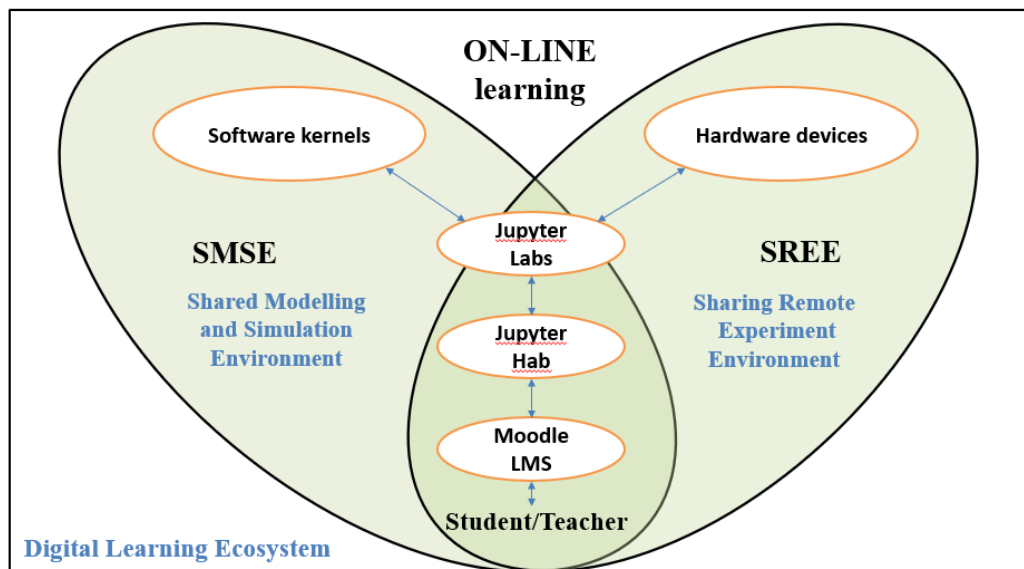
The task of CPNU in framework of DIGITRANS project is to develop of **Sharing Remote Experiment Environment (SREE)**. Particular objectives will include:

- to develop the platform for on-line laboratory works with physical equipment of remote laboratories for learning and teaching practical topics in computer and electronic engineering;
- to integrate SREE with Sharing Modelling and Simulation Environment (SMSE) that affords virtual laboratories based on open software kernels using Jupyter Notebooks, for resulting acquisition and piloting of Digital Learning Ecosystem (DLE);



- to create methodology of implementing and sharing remote applications of the HEIs laboratories' equipment and software tools for distance usage in framework of DLE based on application of ICT tools.

CPNU planned to integrate SREE with SMSE in DLE in the way that is shown below.





## 2. Kharkiv National Automobile and Highway University, KhNAHU

### 2.1 Summary

The DIGITRANS project aims to increase graduates' employability, support sustainable growth and jobs at Ukraine and Moldova, in line with the Green and Digital transition, through implementation of supporting measures such as:

- Integration of research and training in such a way that students have the opportunity to conduct research at partner universities and enterprises. Introduction of integrated thematic complexes that will give students the opportunity to achieve additional learning outcomes.

- Development of innovative educational programs of electrical engineering, information and computer systems, cybersecurity, automatic control engineering, electrical and electronic equipment, engineering and management in road transport, electro mobiles, automotive manufacturing, as well as necessary competences of transversal skills and entrepreneurship knowledge aligned with the Green Deal and Fit for 55 EU strategic aims.

- Development and implementation of Double Diploma programs between EU and Ukrainian, Moldavian universities.

- Introduction of innovative practical training schemes in conjunction with relevant industrial partners, e.g., internship, professional courses at enterprises, etc.

- Digitalization of education with practical training of students in specific skills with increasing demand in the job market, e.g. specific software for diagnostics, repair and maintenance of a modern type of transport, etc.

- Development of virtual and remote practice (labs), e.g. classes for modelling, simulation, building and debugging models, etc.

- Developing Sharing Remote Experiment Environment as a digital distributed educational infrastructure supporting the Digital Learning Ecosystem.

- Developing an open interface for interconnection of Digital Learning Ecosystem and e-learning platforms of partners universities to the forthcoming Open University Platform in Ukraine.

- Providing an opportunity to academic staff and students fleeing from Ukraine or internally displaced as refugees to be involved in an education process through the Digital Learning Ecosystem of DIGITRANS.

### 2.2 Brief Description of the Educational System

**KhNAHU**, a state university founded in 1930, is one of the leading technical universities in Ukraine with the highest level of accreditation. It provides training of bachelors in 20 fields of knowledge and masters in 18 fields. The amount of academic staff is 435 professors' and teachers' staff among them 336 staff with degrees and titles of honour, 60 Doctors of Science and 276 PhDs. The number of students is 7,460 including 554 international students. 6 faculties and 33 departments of KhNAHU offer higher education programmes in engineering and automobile transport.

**Ukraine** is an independent state located in the southeastern part of Europe, washed by the Black and Azov seas. It is the largest country that lies entirely in Europe. In addition, the



geographical center of Europe is located on the territory of Ukraine - not far from the city of Rakhov, Zakarpattia region.

The capital of Ukraine is the hero city of Kyiv, which is also the country's largest city and one of the oldest cities in Europe. Kharkiv, Dnipro, Donetsk, Odesa, and Lviv are also among the largest cities of our country.

The state language is Ukrainian, and the national currency is the hryvnia.

The time of the second time zone UTC+2 is valid throughout the territory of Ukraine. The climate is moderate, the temperature changes insignificantly in summer and winter, reaching maximum values in July and minimum values in January.

Ukraine is an industrial-agrarian country with a predominance of raw material production. One of the leading branches of the country's economy is agriculture. The country is rich in unique Ukrainian chernozems. They were formed under steppe vegetation in a climate that, unlike the steppes of Eurasia, is milder and more humid, due to the influence of the Atlantic and southern seas.

Other leading sectors of the economy: electricity, coal, fuel, oil and gas industry.

**Higher education** (according to the Law of Ukraine dated 01.07.2014 No. 1556-VII "On Higher Education") - a set of systematized knowledge, skills and practical skills, ways of thinking, professional, worldview and civic qualities, moral and ethical values, other competences acquired in a higher educational institution (scientific institution) in the relevant field of knowledge for a certain qualification at the levels of higher education, which in terms of complexity are higher than the level of full general secondary education

The structure of higher education in Ukraine is determined in accordance with the Law of Ukraine dated July 1, 2014 No. 1556-VII "On Higher Education".

#### **Levels of higher education in Ukraine**

Specialists with higher education are trained according to the relevant educational-professional, educational-scientific, scientific programs at the following levels of higher education:

- initial level (short cycle) of higher education;
- first (bachelor) level;
- second (master's) level;
- third (educational and scientific) level;
- scientific level.

Obtaining a higher education at each level of higher education requires a person to successfully complete the corresponding educational (educational-professional or educational-scientific) or scientific program, which is the basis for awarding the corresponding degree of higher education:

- junior bachelor;
- bachelor;
- master's degree;
- doctor of philosophy;
- Doctor of Science.

**A junior bachelor** is an educational and professional degree obtained at the initial level (short cycle) of higher education and awarded by a higher educational institution as a result



of successful completion by the student of higher education of an educational and professional program, the volume of which is **90-120 ECTS<sup>2</sup> credits**.

A person has the right to obtain a junior bachelor's degree, provided that he has a complete general secondary education.

**A Bachelor's degree** is an educational degree obtained at the first level of higher education and awarded by a higher educational institution as a result of successful completion of an educational and professional program by the student of higher education, the volume of which is **180-240 ECTS credits**. The scope of the educational and professional program for obtaining a bachelor's degree based on the junior bachelor's degree is determined by the higher educational institution.

A person has the right to obtain a bachelor's degree, provided that he has a complete general secondary education.

**A master's degree** is an educational degree obtained at the second level of higher education and awarded by a higher educational institution (scientific institution) as a result of successful completion of the relevant educational program by the student of higher education. A master's degree is obtained by an educational-professional or an educational-scientific program. The volume of the educational and professional master's training program is **90-120 ECTS credits**, the volume of the educational and scientific program is 120 ECTS credits. The master's educational and scientific program necessarily includes a research (scientific) component of at least 30 percent.

A person has the right to obtain a master's degree, provided that he has a bachelor's degree.

**Doctor of Philosophy** is an educational and at the same time the first scientific degree obtained at the third level of higher education on the basis of a master's degree. The degree of Doctor of Philosophy is awarded by the specialized academic council of a higher educational institution or scientific institution as a result of successful completion of the relevant educational and scientific program by the student of higher education and the public defense of the dissertation in the specialized academic council.

A person has the right to obtain the degree of Doctor of Philosophy while studying at a graduate school (adjunct). Persons who professionally carry out scientific, scientific-technical or scientific-pedagogical activities at their main place of work have the right to obtain the degree of Doctor of Philosophy outside of postgraduate studies, in particular during a creative leave, provided they successfully complete the relevant educational and scientific program and publicly defend their dissertation in the specialized scientific council.

The standard period of training for a doctor of philosophy in post-graduate studies (adjunct) is four years. The volume of the educational component of the educational and scientific program for the preparation of a doctor of philosophy is **30-60 ECTS credits**.

**Doctor of Science** is the second scientific degree obtained by a person at the scientific level of higher education on the basis of the Doctor of Philosophy degree and involves the

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<sup>2</sup> **ECTS** - European credit and transfer system. The volume of one ECTS credit is 30 hours. The workload of one academic year in the full-time form of education is, as a rule, 60 ECTS credits.





acquisition of the highest competencies in the field of development and implementation of research methodology, conducting original research, obtaining scientific results that provide the solution of an important theoretical or applied problem, have national or world significance and are published in scientific publications.

The degree of Doctor of Sciences is awarded by a specialized academic council of a higher educational institution or scientific institution based on the results of a public defense of scientific achievements in the form of a dissertation or a published monograph, or based on a set of articles published in domestic and international peer-reviewed professional publications, the list of which is approved by the central executive authority in the field of education and science.

### **2.3 Accreditation System**

**Accreditation of educational programs** in the system of higher education in Ukraine is carried out in accordance with the Laws of Ukraine "On Education", "On Higher Education", the statute of the National Agency for Quality Assurance of Higher Education (National Agency) and the **Regulations on the Accreditation of Educational Programs, according to which the training of students of higher education is carried out of education** (Approved order of the Ministry of Education and Science of Ukraine dated July 11, 2019 No. 977) (hereinafter - REGULATIONS).

Accreditation is carried out at the initiative of the educational institution and is carried out by the National Agency.

#### **The purpose of accreditation is:**

- 1) confirmation of compliance of the educational program and educational activities under this program with the criteria defined by these Regulations;
- 2) provision of recommendations and consultations to educational institutions regarding the improvement of the educational program and educational activities under this program;
- 3) providing all interested parties with information about the educational program, educational activities under this program (including scientific achievements), the effectiveness of processes and procedures for internal quality assurance of higher education under the educational program;
- 4) strengthening of trust in higher education in Ukraine;
- 5) promoting the integration of Ukrainian educational institutions into the European Higher Education Area.

Accreditation of the educational program is carried out in accordance with the criteria for evaluating the quality of the educational program listed in the appendix to the REGULATIONS (hereinafter referred to as the Criteria).

Standards and recommendations for quality assurance in the European area of higher education and recommendations provided by the National Agency can be used to apply and clarify the Criteria.

The criteria are used by the educational institution for the preparation of information on self-assessment, as well as by the National Agency, its industry expert councils (hereinafter - GER) and experts during accreditation.

Evaluation of the educational program and educational activities under this program is carried out according to each Criterion according to the rating scale, which covers four levels of compliance:



- **level "F"** - the educational program and/or educational activities under this program do not meet the defined Criterion, and the identified deficiencies are of a fundamental nature and/or cannot be eliminated within one year;
- **level "E"** - the educational program and/or educational activities under this program do not fully meet the defined Criterion, and the identified deficiencies can be eliminated within one year;
- **level "B"** - the educational program and educational activities under this program fully meet the defined Criterion or generally meet the defined Criterion with shortcomings that are not significant;
- **level "A"** - the educational program and educational activities under this program fully meet the defined Criterion, and also have an innovative/exemplary character.

Accreditation is carried out for the first time during the last or penultimate year of study of the first set of education seekers under a certain educational program.

The next (regular) accreditation is carried out during the last year of validity of the certificate of accreditation of the relevant educational program. If an educational institution applies for accreditation after the expiry of the relevant certificate, such accreditation is considered accreditation for the first time.

The educational institution has the right to prematurely initiate the next (regular) accreditation.

During one academic year, an educational institution has the right to apply for accreditation of one educational program only once.

## **2.4 Structure of BSc, MSc and PhD programs**

### **Program description**

**Field of knowledge:** 14 «Electrical engineering»

**Specialty** 141 «Power engineering, electrical engineering and electromechanics»

**Level first** (bachelor)

**Study program** «Electric vehicles and automotive electronics»

**Type of diploma and scope** of the educational program: Bachelor's diploma, single, 240 ECTS credits, study period: 3 years 10 months.

Availability of accreditation: Certificate of accreditation of the educational program "Electric vehicles and automotive electronics", 141 "Power engineering, electrical engineering and electromechanics", valid until 16.05.2024.

**In 2024, it is planned to conduct the accreditation of the Study program "Electric vehicles and automotive electronics".**

**Cycle / level:** HPK of Ukraine - 6th level / Bachelor, FQ-EHEA - first cycle, EQF LLL - 6th level.

**Prerequisites:** Possession of a document on complete general secondary education or the educational and qualification level of a junior specialist, certificates of vocational training. Admission conditions are determined by the "Rules of admission to the Kharkiv National Automobile and Road University", approved by the Academic Council of the National Academy of Sciences of Ukraine.

**Teaching language:** Ukrainian.

**Object of study and/or activity:** enterprises of the electric power complex, electrotechnical and electromechanical services of organizations; departments of





enterprises for the design and operation of electrical equipment and electronic systems of automobile transport, technical service stations, diagnostics and repair of electric vehicles and automobile electronics; electrotechnical equipment, electromechanical and switching equipment, electromechanical and electrotechnical complexes and systems.

**Training goals:** Training of specialists capable of solving specialized tasks and practical problems of electric power, electrical engineering and electromechanics, which involves the application of theories and methods of physics and engineering sciences and is characterized by the complexity and uncertainty of conditions.

Theoretical content of the subject area: basic concepts of the theory of electric and electromagnetic circuits, modeling, optimization and analysis of operating modes of electrotechnical and electromechanical systems and complexes, electric machines, electric drives, electric and electromechanical systems of electric vehicles and automotive electronics.

**Methods, techniques and technologies:** analytical methods of calculating electric circuits, power supply systems, electric machines and devices, microprocessor control systems of electromechanical motor vehicle systems.

Instrumentation and equipment: modern computer and information equipment, microcontroller control units, electrotechnical and electromechanical equipment, electric vehicles, blocks and systems of automotive electronics of a modern car, diagnostic equipment and software products used in professional activities.

**Academic rights of graduates:** The possibility of studying in the program of the second cycle of FQ-EHEA, level 7 EQF-LLL and level 7 HPK

**The main focus of the educational program** and specialization. Emphasis is placed on the acquisition of knowledge and professional skills in the construction, operation and maintenance of electric vehicle systems and automotive electronics, which are a direct result of the integration of electric power, electrical engineering and electromechanics in automotive transport.

**Features of the program.** The program provides an opportunity to acquire knowledge of the structure, operation and design and skills of operation, maintenance, diagnosis and repair of electric vehicle systems and automotive electronics. The program combines theoretical and practical training of applicants with the use of electric power systems, microprocessor complexes, modern means of measuring the parameters of electrical circuits, hybrid and electric vehicles and their diagnostics.

**Link to the structure and description of the Study program "Electric vehicles and automotive electronics":** <https://af.khadi.kharkov.ua/chairs/avtomobilnoji-elektroniki/specialnist-141/pidgotovka-bakalavriv/>

**Link to the Educational site of KhNAHU,** where distance courses of the Study program "Electric vehicles and automotive electronics" are developed: <https://dl2022.khadi-kh.com/course/index.php?categoryid=32>

**KhNAHU will develop and accredit Double Diploma study program** "Electric vehicles and automotive electronics" in cooperation with RTU.

**The topics of the 7 courses** Study programs "Electric vehicles and automotive electronics" will be updated, and laboratory practices will be developed and updated following the purchased equipment for the educational laboratory:



- 1) Complex for teaching and practical research on EV:
  - lithium-ion battery;
  - Electric Vehicle System (EVS) (EVS includes: Motor; Inverter unit; Vehicle Control Module (VCM); DC/DC converter; Onboard charger; Onboard charger connector; Trickle charge cable);
  - Electric vehicle transmission;
  - Tablet;
  - Car diagnostic scanner;
  - Notebook.
- 2) Interactive Kit for blended learning

## 2.5 Existing Study Programs

### Kharkiv National Automobile and Highway University

Study program «Electric vehicles and automotive electronics»

Field of knowledge: 14 «Electrical engineering»

Specialty 141 «Power engineering, electrical engineering and electromechanics»

Level first (bachelor)

| No | Disciplines, programs                             | Semester of study | Credits | Course works | Form of control (credit / exam) |
|----|---|-------------------|---------|--------------|---------------------------------|
| 1  | History and culture of Ukraine                    | 1                 | 3       |              | credit                          |
| 2  | Foreign language (for professional purposes)      | 1-3               | 7       |              | credit, exam                    |
| 3  | Ukrainian language (for professional purposes)    | 2                 | 3       |              | exam                            |
| 4  | Philosophy  | 2                 | 3       |              | exam                            |
| 5  | Higher mathematics                                | 1-2               | 8       |              | credit, exam                    |
| 6  | Physics   | 2                 | 4       |              | exam                            |
| 7  | Computer information systems and technologies     | 2                 | 4       |              | credit                          |
| 8  | Ecology   | 3                 | 3       |              | credit                          |
| 9  | Labor protection                                  | 6                 | 3       |              | exam                            |
| 10 | Electrical materials                              | 1                 | 4       |              | exam                            |
| 11 | Engineering and computer graphics                 | 1                 | 4       |              | credit                          |
| 12 | Theory of electric vehicles                       | 1                 | 3       |              | credit                          |
| 13 | Vehicles  | 1                 | 5       |              | exam                            |
| 14 | Basics of metrology and electrical measurements   | 1                 | 5       |              | exam                            |
| 15 | Theoretical foundations of electrical engineering | 2-3               | 14      | +            | credit, exam                    |
| 16 | Electronics and microcircuits                     | 3-5               | 15      | +            | exam                            |
| 17 | Electric machines and devices                     | 4                 | 5       |              | exam                            |
| 18 | Energy supply and energy saving systems           | 4                 | 4       |              | exam                            |



| No                      | Disciplines, programs   | Semester of study | Credits    | Course works | Form of control (credit / exam) |
|-------------------------|---|-------------------|------------|--------------|---------------------------------|
| 19                      | Electrical systems and complexes of vehicles  | 4-6               | 13         |              | exam                            |
| 20                      | Applied mechanics   | 5                 | 6          | +            | exam                            |
| 21                      | Theory of automatic control   | 5-6               | 10         | +            | exam                            |
| 22                      | Theory of electric drive  | 6-7               | 11         | +            | exam                            |
| 23                      | Microprocessor devices  | 7                 | 6          | +            | exam                            |
| 24                      | Simulation of electromechanical systems   | 7-8               | 10         | +            | exam                            |
| 25                      | Power electronics   | 8                 | 3          |              | exam                            |
| 26                      | Educational practice  | 2                 | 3          |              |                                 |
| 27                      | Technological practice  | 4                 | 3          |              |                                 |
| 28                      | Production practice   | 6                 | 3          |              |                                 |
| 29                      | Undergraduate practice  | 8                 | 3          |              |                                 |
| 30                      | Performance of qualification work   |                   | 12         |              |                                 |
| <b>ELECTIVE COURSES</b> |   |                   |            |              |                                 |
| 32                      | <i>Socio-political problems of modern society</i>   | 6                 | 3          |              | <i>credit</i>                   |
| 33                      | <i>Economic theory</i>  | 5                 | 3          |              | <i>credit</i>                   |
| 34                      | <i>Psychology</i>   | 4                 | 3          |              | <i>credit</i>                   |
| 35                      | <i>Foreign language (special course)</i>  | 7                 | 3          |              | <i>credit</i>                   |
| 36                      | <i>Marketing</i>  | 8                 | 3          |              | <i>credit</i>                   |
| 37                      | <i>Probability theory</i>   | 3                 | 3          |              | <i>credit</i>                   |
| 38                      | <i>Physics (special course)</i>   | 3                 | 3          |              | <i>credit</i>                   |
| 39                      | <i>Mathematical methods in engineering and technology</i>   | 4                 | 3          |              | <i>credit</i>                   |
| 40                      | <i>Theoretical mechanics</i>  | 3                 | 4          |              | <i>credit</i>                   |
| 41                      | <i>Basics of programming</i>  | 4                 | 4          |              | <i>credit</i>                   |
| 42                      | <i>Vehicle engines</i>  | 5                 | 4          |              | <i>credit</i>                   |
| 43                      | <i>Fundamentals of computer-aided design systems for electrical systems and vehicle complexes</i> | 6                 | 4          |              | <i>credit</i>                   |
| 44                      | <i>Theory of vehicle</i>  | 6                 | 4          |              | <i>credit</i>                   |
| 45                      | <i>On-board computing complexes of vehicles</i>   | 7                 | 4          |              | <i>credit</i>                   |
| 46                      | <i>Diagnosis of mechatronic vehicle systems</i>   | 7                 | 4          |              | <i>credit</i>                   |
| 47                      | <i>Computer diagnostics of vehicles</i>   | 7                 | 4          |              | <i>credit</i>                   |
| 48                      | <i>Theory and methods of scientific creativity</i>  | 8                 | 4          |              | <i>credit</i>                   |
| <b>TOTAL, credits</b>   |   |                   | <b>240</b> |              |                                 |



### **Competences:**

1. Ability to solve practical problems using an automated design and calculation system (CAD).
2. Ability to solve practical problems with the involvement of methods of mathematics, physics and electrical engineering.
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 technology.
4. Ability to solve complex specialized problems and practical problems related to metrology, electrical measurements, operation of automatic control devices, relay protection and automation.
5. Ability to solve complex specialized problems and practical problems related to the operation of electric machines, devices and automated electric drive.
6. Ability to solve complex specialized problems and practical problems related to the production, transmission and distribution of electricity.
7. Ability to develop projects of electric power, electrical and electromechanical equipment in compliance with the requirements of legislation, standards and specifications.
8. Ability to perform professional duties in compliance with the rules of safety, health, industrial sanitation and health.
9. Awareness of the need to increase electricity efficiency of electrical, electrical and mechanical equipment.
10. Awareness of the need to constantly expand their knowledge of new technologies in power engineering, electrical engineering and electromechanics.
11. Ability to work routine measures in emergency situations (emergencies in power and electromechanical systems).
12. Ability to solve complex specialized problems and practical problems related to the operation of automotive electronics, electrical systems and complexes of vehicles, electric vehicles and charging station infrastructure.
13. Ability to solve complex specialized problems and practical problems related to the operation of cars, automotive systems and units of both mechanical and electromechanical action.
14. Ability to develop and improve systems and units of road transport of electric, electromechanical and mechanical principle of operation in compliance with the requirements of legislation, standards and specifications.

### **Suitability for employment:**

- Technical specialist – electrician;
- Car service manager;
- Developer of vehicle electrical systems;
- Managers and technical managers of production sites, departments, institutions;
- Senior managers, managers of technical and electrical institutions, organizations, departments, enterprises, etc.;
- Masters of production sites and service stations;
- Engineers of design bureaus;
- Researchers;



- Specialists in computer diagnostics of service stations;
- Electrical engineers.

#### **Strengths (advantages) of training at AF KhNAHU:**

1. Highly professional teachers work at the faculty, 100% of whom have academic degrees and titles, national and international awards, long-term experience of working with foreign students, possess modern educational technologies, have numerous scientific publications in leading international electrical journals

2. Vehicle Electronics Department is the only department in Ukraine that trains highly qualified specialists in the development, maintenance, and repair of modern electrical and electronic systems of cars.

3. Students majoring in «Power Engineering, Electrical Engineering and Electromechanics» on a regular basis participate in prestigious international scientific and student conferences, internships in the best European technical universities, visit the largest automotive companies. The main direction of scientific and scientific-technical activity of the Vehicle Electronics Department is Energy-efficient and energy-saving technologies in transport. This is true in all sectors of the economy and business.

4. In addition to training in the specialty, students study special issues of business and economics of road transport, the development and modernization of the infrastructure of modern transport, electrical systems and vehicle complexes, programming of electronic circuits, the theory of electric drive, etc. Students carry out real coursework and diploma projects based on the initial data of motor transport enterprises and companies.

#### ***2.5.1 Proposed modifications / additions***

7 courses and laboratory practicums for BSc level students will be developed and modernised in the framework of one program which will be modernised and accredited by the Ministries of Educations and Science of Ukraine:

- Electric vehicle infrastructure,
- Energy supply and energy saving systems,
- Electric drive theory (Part 1),
- Electric drive theory (Part 2),
- Electric machines and devices,
- Electronics and microcircuit engineering (Part 1),
- Electronics and microcircuit engineering (Part 2).

#### ***2.5.2 Justification of proposed modifications / additions***

The proposed modernization of 7 courses and laboratory practicums will improve the quality of the educational process and update the educational and material base for high-quality training. All this will make it possible to develop and implement in the educational process a double diploma program between KhNAHU and partner universities from European countries. Thus, as part of the implementation of the DIGITRANS project, the development and introduction into the educational process of the bachelor's degree double diploma program between KhNAHU and RTU is foreseen.



All of this is to increase graduates' employability and support sustainable growth and jobs in Ukraine and Moldova, in line with the Green and Digital transition, through the implementation of supporting measures.

The purchase of equipment for educational laboratories and the development of modern laboratory workshops will allow students to have the opportunity to conduct research at partner universities and enterprises. Introduction of integrated thematic complexes that will allow students to achieve additional learning outcomes.

Development of innovative educational programs of electrical engineering, information and computer systems, cybersecurity, automatic control engineering, electrical and electronic equipment, engineering and management in road transport, electro mobiles, automotive manufacturing, as well as necessary competencies of transversal skills and entrepreneurship knowledge aligned with the Green Deal and Fit for 55 EU strategic aims.

All this will make it possible to build the DIGITRANS digital learning ecosystem. It provides opportunities for teachers and students who fled Ukraine or are internally displaced persons as refugees to engage in the educational process through the DIGITRANS digital learning ecosystem.

The development of the Digital Learning Ecosystem of DIGITRANS will allow all participants in the educational process to conduct not only lectures, but also laboratory and practical classes, being far from their university.

The development and modernization of courses, the introduction of purchased equipment and the Digital Learning Ecosystem of DIGITRANS into educational process, as well as availability of text e-books will allow refugees and internally displaced persons, to conduct their study without sacrificing the quality of the educational process.

In addition, the development and implementation of double degree programs between Ukrainian / Moldovan universities and European partner's universities will allow integrating the educational process of partner universities into the European educational environment. This approach will greatly simplify teaching/learning for refugees, as they will be able to conduct training / study according to the program of their university, while being far outside their country.

## ***2.6 Digital and labs resources for the integration into Digital Learning Ecosystem of DIGITRANS***

The Laboratory of Energy-saving technologies in transport (KhNAHU) has a computer class with interactive equipment that can be integrated into the Digital Learning Ecosystem of DIGITRANS. With the help of existing laboratory equipment and what is planned to be purchased under the DIGITRANS project, it is possible to carry out simulations of the flow of electrical processes, carry out their calculations, conduct lectures, and practical and laboratory classes.

**The Laboratory of Energy-saving technologies in transport (KhNAHU) has such equipment that can be integrated into the Digital Learning Ecosystem of DIGITRANS:**

- 1) Computer classroom for 15 places (Artline Business; monitor 24"; Keyboard + Mouse).
- 2) Interactive kit Newline NLE-805.
- 3) Complex for teaching and practical research on electric vehicles:
  - lithium-ion battery;





- Electric Vehicle System (EVS) (EVS includes: Motor; Inverter unit; Vehicle Control Module (VCM); DC/DC converter; Onboard charger; Onboard charger connector; Trickle charge cable);
- electric vehicle transmission;
- ELM327 Bluetooth mini OBDII (CAN-BUS V.2.1);
- Launch EasyDiag 2.0;
- laptop 2E Imaginary 15 - 13 units;
- laptop 2E Complex Pro 17 - 5 units;
- laptop Lenovo Yoga Slim 7 Pro - 2 pcs;
- Monitor Dell 24" - 20 units.

According to the DIGITRANS project, it is planned to purchase the following equipment, which will be part of The Laboratory of Energy-saving technologies in transport and will be integrated into the Digital Learning Ecosystem of DIGITRANS:

1) Complex for teaching and practical research on EV:

- Lithium-ion battery;
- Electric Vehicle System (EVS) (EVS includes: Motor; Inverter unit; Vehicle Control Module (VCM); DC/DC converter; Onboard charger; Onboard charger connector; Trickle charge cable);
- Electric vehicle transmission;
- Tablet;
- Car diagnostic scanner;
- Notebook.

2) Interactive Kit for blended learning.

### **2.7 Motivation for project development**

Education for sustainable development (ESD) plays a significant role in achieving the Sustainable Development Goals (SDGs) and simultaneously tackling the current global ecological challenges. ESD further required a rapid shift from teacher-centred to learner-centred approaches with task-based instruction, problem orientation, interdisciplinarity, and transdisciplinarity, and also the use of digital tools and approaches in the development of required competencies for promoting sustainable development. The need for a labour force with skill sets that made it possible to establish and sustain new environmental industries, services, and practices is proposed by the global urgency for sustainable development. The global challenges of the transition towards low-carbon energy, with energy security as well as accessibility and affordability, cannot be successfully addressed without the contribution of knowledge-based innovations drawing on education and research in a broad range of industries. Furthermore, in the era of the “digital revolution”, all methods and solutions must be aligned with up to date digital and ICT tools.

New innovative solutions are requested along the entire value chain in the different economy sectors of Moldova and Ukraine. The fostering of education, research and innovation will play a significant role in the sustainable development of Moldova and Ukraine.

DIGITRANS project will address integral solutions to enhance better employability of graduates of HEIs in Moldova and Ukraine adhering to the goals of the twin green-digital



transition. This goal will be achieved through implementing comprehensive measures, which include: the design of innovative curricula and introducing innovative elements in the existing curricula, the implementation of innovative learning and teaching methods, the active engagement with the business world and with research, the organisation of continuing educational programmes and activities with and within enterprises and the strengthening of the capacities of HEIs in Moldova and Ukraine with the focus on electrical engineering, information and computer systems, wireless networking technologies, cybersecurity, automatic control engineering, electrical and electronic equipment, engineering and management in road transport, electro mobiles, automotive manufacturing.

DIGITRANS project will encourage institutional reforms due to enhancing digital skills and modern university services, by strengthening quality assurance processes, tools and methods for professionalisation and professional development of academic, technical and administrative staff. In addition to technical classes, the transversal skills learning, entrepreneurship education and its practical application will be introduced in the student's education curricula.

DIGITRANS project focus on the overarching priority of the Digital transformation that will be implemented by fostering links between Education, Research and Business in the area of digitalisation.

Digital skills, distance learning, learning and teaching innovations solution will be developed in the project, which would be used in remote and rural areas.

DIGITRANS project aims to contribute in the Sustainable growth and jobs and the priority of Region 2 "Boost linkage between academic, research and private sector, with education programs addressing current and future skills needs of local labour markets, thereby achieving economies that work for all and contributing to green transition".





### 3. Lutsk National Technical University, LNTU

#### 3.1 Summary

At the moment, the following educational programs in the specialty "Automotive Transport" are being implemented at LNTU:

- the educational program "Automotive transport" of the bachelor's level of higher education. The volume of the program is 240 ECTS, the duration of study is 3 years and 10 months. The purpose of the educational program is to train highly qualified specialists with thorough theoretical knowledge and skills in the field of road transport, necessary for the effective implementation of professional activities in the field of road transport at enterprises, institutions, organizations, capable of continuing their studies in the programs of the second cycle of higher education and training at production. The educational program is accredited by the National Agency for Quality Assurance of Higher Education of Ukraine in 2022.

- educational program "Automotive transport" of the master's level of higher education. The volume of the program is 90 ECTS, the duration of study is 1 year and 4 months. The purpose of the educational program is to train highly qualified specialists with thorough theoretical knowledge and skills in the field of road transport, necessary for the effective implementation of professional activities in the field of operation of road transport at enterprises, institutions, organizations, capable of continuing their education under the programs of the third cycle of higher education and training in production. The educational program was accredited by the Ministry of Education and Science of Education of Ukraine in 2019.

- educational program "Automotive transport" of the master's level of higher education. The volume of the program is 60 ECTS, the duration of study is 3 years and 10 months. The purpose of the educational program is to train highly qualified specialists with thorough theoretical knowledge and skills in the field of road transport, necessary for the effective implementation of professional, scientific and pedagogical activities in the field of road transport at enterprises, institutions, organizations, capable of solving complex problems and carrying out original independent scientific research in the field of road transport, safety and reliability of vehicles, intelligent transport systems. Accreditation of the educational program is planned for 2026.

Despite the military situation in Ukraine, educational programs are in demand. Periodic monitoring and discussion with stakeholders is carried out.

#### 3.2 Brief Description of the Educational System

Lutsk National Technical University (LNTU) was established in 1966 and in 2008 received the status of a National university. It is situated in the city of Lutsk, Volyn region,



located in northwest Ukraine. The University occupies an area of 60,990,000 square meters. Four buildings of LNTU are well equipped with modern facilities for study and research. LNTU Sports Complex with 25 meters long pool, new stadium and gym, two fitness centres and a room for aerobics offer students and staff a wide range of sports, leisure and recreational pursuits, aimed to provide our academic society with a quality sports, health and fitness experience.

Nowadays university comprises 7 Faculties, 35 departments, 3 centres, 3 technical colleges. The total number of academic staff is 400 persons, among them 45 Doctors of Science and Professors, 276 Candidates of Science and Associate Professors, Academicians and Corresponding Members of branch academies. The academic staff of the university's departments takes an active part in the cooperation with the learners, research and business.

LNTU prepares professionals in more than 30 specialties on such faculties: Faculty of Business and Law, Faculty of Customs, Materials and Technologies, Faculty of Agricultural Technologies and Environmental Studies, Faculty of Computer and Information Technologies, Faculty of Architecture, Construction and Design, Faculty of Digital, Educational and Social Technologies, Faculty of Transport and Mechanical Engineering.

Information on the national higher education system in Ukraine

Types of higher education institutions and their status

Higher education studies in Ukraine are offered by the following higher education institutions:

– a university is a multisectoral or sectoral higher education institution that carries out educational activities for various degrees of higher education (including PhD), conducts fundamental and/or applied research;

– academies and institutes are sectoral higher education institutions that carry out educational activities at the first (Bachelor) and second (Master) levels of higher education in one or several Fields of Study, as well as at the third and higher scientific levels of higher education for certain Programme Subject Areas, and conduct fundamental and/or applied research;

– a college is a higher education institution or structural unit of a university, academy or institute that carries out educational activities for a Bachelor's Degree and/or a Junior Bachelor's Degree, conducts applied research and/or creative art activity. The status of a college is granted to an educational institution (structural unit of an educational institution) in which provision of higher education for Bachelor's Degree and/or a Junior Bachelor's Degree accounts for not less than 30 percent of the total licensed volume of a college.

The status of a national higher education institution is honorary, is awarded for the significant contribution to the development of higher education, science and culture of Ukraine, and is reflected in the official name of a higher education institution.

Types of Educational Programmes and Degrees

Since 2002 higher education studies in Ukraine have been conducted for educational programmes leading to a Junior Specialist's degree (incomplete higher education), a Bachelor's Degree (basic higher education), a Specialist's Degree (complete higher education) and a Master's Degree (complete higher education).

In 2005 Ukraine joined Bologna Process and, in a decade, a three-cycle system of higher education studies (Bachelor, Master and PhD) has been successfully introduced. After

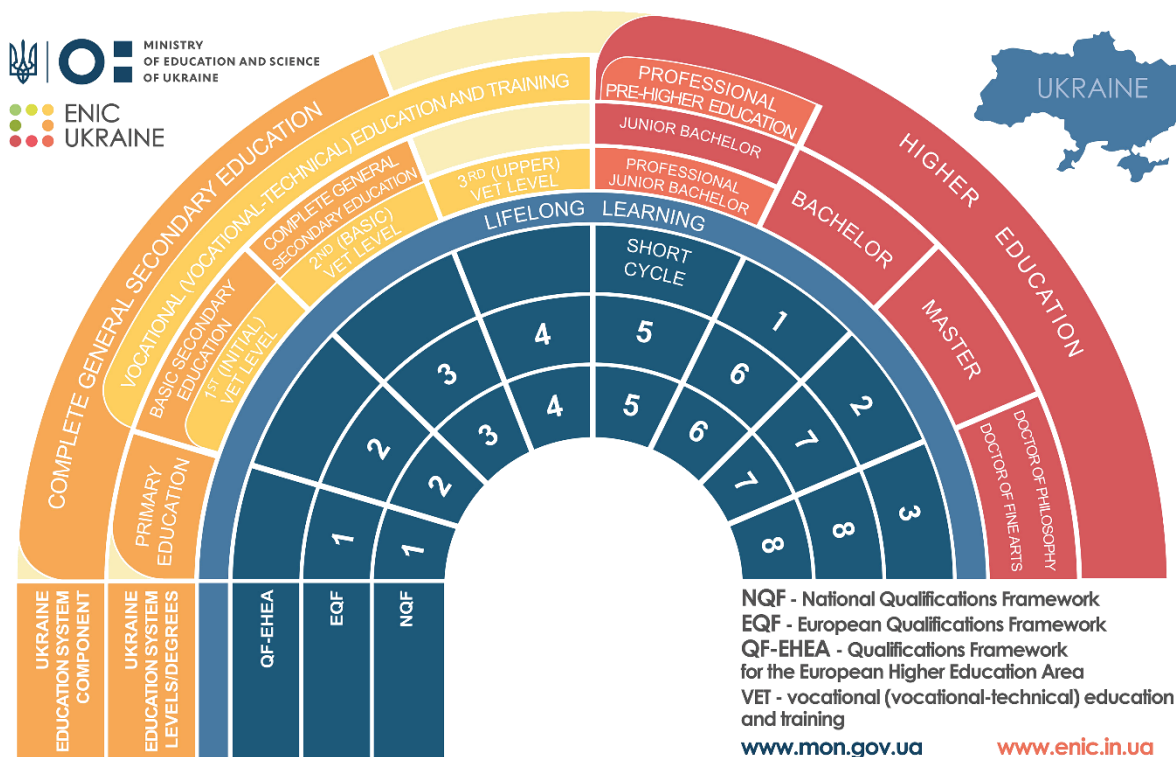


adoption in 2014 of the Law of Ukraine «On Higher Education», a three-cycle system has gradually been introduced in educational programmes of higher education institutions. This change has provided enlarged variety and flexibility to students in planning and pursuing individual educational and laid the ground for enhancing compatibility of educational process in Ukraine and other countries of the European Higher Education Area. Furthermore, the initial level (short cycle) of higher education remains indispensable in the higher education system of Ukraine.

Preparation at the levels of higher education is carried out through academic and professional education programmes. Higher educational institutions (research institutions) develop and approve educational programmes independently, while considering the requirements for the level of higher education established by the legislation and standards of higher education by levels of higher education and each Programme Subject Area.

### NATIONAL QUALIFICATIONS FRAMEWORK OF UKRAINE

Approved by the Resolution of the Cabinet of Ministers of Ukraine № 1341, dated November 23, 2011, as amended by the Resolution of the Cabinet of Ministers of Ukraine № 519, dated June 25, 2020



Standards of higher education are developed according to the National Qualifications Framework that includes description of the qualification levels and levels/degree of the Ukrainian higher education system, and is harmonized with the European Qualifications Framework for lifelong learning and Framework for Qualifications of the European Higher Education Area.

Preparation in the higher education system is carried out at the initial level (short cycle) of higher education, first (bachelor’s) level, second (master’s) level, and third



(educational-scientific / educational-fine arts) level leading to awarding a Junior Bachelor's Degree, a Bachelor's Degree, a Master's Degree, and Doctor of Philosophy Degree.

The last admission for the educational-qualification level of Specialist was held in 2016. After the Law of Ukraine «On Higher Education» entered into force on 06 September 2014, the educational-qualification level of Specialist is equated to a Master's degree of higher education.

After the Law of Ukraine «On Higher Education» entered into force on 06 September 2014, the scientific degree of Candidate of Sciences is equated to the scientific degree of Doctor of Philosophy.

In order to provide, recognize, validate qualifications and educational components, as well as promote academic mobility of higher education students, the higher education system of Ukraine makes use of the European Credit Transfer and Accumulation System (ECTS). One ECTS credit equals 30 working hours.

### **3.3 Accreditation System**

Licensing of education activities and accreditation of educational programmes.

Educational activities in the field of higher education are carried out on the basis of licenses issued by the licensing body designated by the Cabinet of Ministers of Ukraine in accordance with the legislation.

Until 2020 licensing has been obligatory conducted for each Programme Subject Area of higher education institution (research institution) within which higher education studies have been carried out. Since 16 January 2020, the following are subject to licensing in the field of higher education:

- 1) educational activity of a higher education institution at a certain level of higher education;
- 2) educational activities under educational programmes that lead to awarding of a professional qualification in professions with additional regulation.

Information on issuing and annulment of licenses for carrying out educational activities by higher education institutions can be found in the Unified State Electronic Database on Education via the link: <https://registrv.edbo.gov.ua/vishcha-osvita/>

Until 2019 accreditation in the Ukrainian higher education system has been conducted on the level of Field of Study or Programme Subject Area. Since 2019 a system of accreditation of educational programmes has become operational.

The system of higher education quality assurance in Ukraine is comprised of:

- 1) a system by which higher education institutions ensure quality of education activity and higher education (internal quality assurance system);
- 2) a system of external quality assurance for education activity of higher education institutions and higher education;
- 3) a system of quality assurance of the National Agency for Higher Education Quality Assurance and independent agencies for assessment and quality assurance of higher education.

Ukraine recognizes certificates of accreditation of educational programmes issued by foreign accreditation agencies or agencies of higher education quality assurance that are approved by the Cabinet of Ministers of Ukraine. The effective list of such agencies is



approved by the Resolution of the Cabinet of Ministers of Ukraine as of 10 July 2019 No. 554-p on the basis of the European Quality Assurance Register for Higher Education (EQAR).

**Accreditation of educational programs** in the system of higher education in Ukraine is carried out in accordance with the Laws of Ukraine "On Education", "On Higher Education", the statute of the National Agency for Quality Assurance of Higher Education (National Agency) and the **Regulations on the Accreditation of Educational Programs, according to which the training of students of higher education is carried out of education** (Approved order of the Ministry of Education and Science of Ukraine dated July 11, 2019 No. 977) (hereinafter - REGULATIONS).

Accreditation is carried out at the initiative of the educational institution and is carried out by the National Agency.

**The purpose of accreditation is:**

- 1) confirmation of compliance of the educational program and educational activities under this program with the criteria defined by these Regulations;
- 2) provision of recommendations and consultations to educational institutions regarding the improvement of the educational program and educational activities under this program;
- 3) providing all interested parties with information about the educational program, educational activities under this program (including scientific achievements), the effectiveness of processes and procedures for internal quality assurance of higher education under the educational program;
- 4) strengthening of trust in higher education in Ukraine;
- 5) promoting the integration of Ukrainian educational institutions into the European Higher Education Area.

Accreditation of the educational program is carried out in accordance with the criteria for evaluating the quality of the educational program listed in the appendix to the REGULATIONS (hereinafter referred to as the Criteria).

Standards and recommendations for quality assurance in the European area of higher education and recommendations provided by the National Agency can be used to apply and clarify the Criteria.

The criteria are used by the educational institution for the preparation of information on self-assessment, as well as by the National Agency, its industry expert councils (hereinafter - GER) and experts during accreditation.

Evaluation of the educational program and educational activities under this program is carried out according to each Criterion according to the rating scale, which covers four levels of compliance:

- **level "F"** - the educational program and/or educational activities under this program do not meet the defined Criterion, and the identified deficiencies are of a fundamental nature and/or cannot be eliminated within one year;
- **level "E"** - the educational program and/or educational activities under this program do not fully meet the defined Criterion, and the identified deficiencies can be eliminated within one year;
- **level "B"** - the educational program and educational activities under this program fully meet the defined Criterion or generally meet the defined Criterion with shortcomings that are not significant;





- **level "A"** - the educational program and educational activities under this program fully meet the defined Criterion, and also have an innovative/exemplary character.

Accreditation is carried out for the first time during the last or penultimate year of study of the first set of education seekers under a certain educational program.

The next (regular) accreditation is carried out during the last year of validity of the certificate of accreditation of the relevant educational program. If an educational institution applies for accreditation after the expiry of the relevant certificate, such accreditation is considered accreditation for the first time.

The educational institution has the right to prematurely initiate the next (regular) accreditation.

During one academic year, an educational institution has the right to apply for accreditation of one educational program only once.

### **3.4 Structure of BSc, MSc and PhD programs**

#### Organization and Structure of Higher Education Studies

##### Bachelor

Bachelor's Degree is an educational degree obtained at the first level of higher education and awarded by a higher education institution as a result of successful completion of an educational-professional programme carrying 180–240 ECTS credits. Complete general secondary education is the prerequisite for obtaining a Junior Bachelor's Degree. A higher education institution has the right to recognize and transfer ECTS credits, the maximum amount of which is determined by a standard of higher education, for the purpose of obtaining a Bachelor's Degree on the basis of a Junior Bachelor's Degree or on the basis of professional pre-higher education by each Programme Subject Areas. Bachelor's Degree corresponds to level 6 of the National Qualifications Framework, the European Qualifications Framework for lifelong learning and the first cycle of the Framework for Qualifications of the European Higher Education Area.

##### Master

Master's degree is an educational degree obtained at the second level of higher education and awarded by a higher education institution (research institution) as a result of successful completion of an educational programme carrying 90–120 ECTS credits in case of an educational professional programme or 120 ECTS credits in case of an educational-scientific programme. Bachelor's Degree is the prerequisite for obtaining a Master's Degree. Master's Degree corresponds to level 7 of the National Qualifications Framework, the European Qualifications Framework for lifelong learning and the second cycle of the Framework for Qualifications of the European Higher Education Area.

##### Doctor of Philosophy

Doctor of Philosophy Degree is an educational-scientific degree obtained at the third level of higher education on the basis of Master's Degree. A Doctor of Philosophy degree is awarded by a specialized Scientific Council of a higher education institution (research institution) as a result of successful completion of an educational-scientific programme and public defence of a dissertation at a specialized Scientific Council. The normative term of studies for the Doctor of Philosophy degree in postgraduate (adjunct) studies is four years. An educational component of an educational-scientific programme of Doctor of Philosophy



carries 30–60 ECTS credits. Doctor of Philosophy Degree corresponds to level 8 of the National Qualifications Framework, the European Qualifications Framework for lifelong learning and the third cycle of the Framework for Qualifications of the European Higher Education Area.

### **Program description (bachelor)**

**Field of knowledge:** 27 «Transport»

**Specialty** 274 « Motor Vehicle Transport»

**Level first** (bachelor)

**Study program** « Motor Vehicle Transport»

**Type of diploma and scope** of the educational program: Bachelor's diploma, single, 240 ECTS credits, study period: 3 years 10 months.

**Availability of accreditation:** Certificate of accreditation of the educational program «Motor Vehicle Transport», 274 « Motor Vehicle Transport », valid until 01.07.2026.

**Cycle / level:** HPK of Ukraine - 6th level / Bachelor, FQ-EHEA - first cycle, EQF LLL - 6th level.

**Prerequisites:** Possession of a document on complete general secondary education or the educational and qualification level of a junior specialist. Admission conditions are determined by the "Rules of admission to the Lutsk national technical university.

**Teaching language:** Ukrainian.

**The objects** of professional activity of graduates are processes related to all stages of the life cycle motor vehicles and road transport infrastructure.

**The goals** of training are the training of capable specialists solve specialized complex problems and practical problems of road transport.

**Theoretical content** of the subject area design, characteristics, operation and disposal of motor vehicles, appropriate means, infrastructure and technologies.

#### **Methods, techniques and technologies**

- analytical, numerical and experimental studies;
- methods and methods of element calculations designs and systems of automobile transport means, their operational characteristics and reliability indicators;
- technologies of operation, diagnostics, modernization, restoration and recycling motor vehicles, their components;
- technologies of construction and use of objects road transport infrastructure;
- methods of technical and economic calculations activity (efficiency) indicators road transport, information and information and communication technologies.

#### **Tools and equipment:**

- devices and instruments for measuring physical values and parameters;
- full-scale samples or mock-ups of automobiles vehicles and infrastructure facilities road transport;
- specialized software;
- information and analytical support systems adoption of management, technical and technological solutions.

**Academic rights of graduates:** The possibility of studying in the program of the second cycle of FQ-EHEA, level 7 EQF-LLL and level 7 HPK, receiving additional qualifications in the adult education system



**The main focus of the educational program.** Specialist training is focused on formation ability to carry out effective management operational life cycle of wheels vehicles, their components and objects infrastructure.

**Features of the program.** The educational program provides for the acquisition of practical skills skills in designing, manufacturing and research of wheeled vehicles, them component parts and elements

**Link to the structure and description of the Study program** «Motor Vehicle Transport»: <https://drive.google.com/file/d/1HE3UP6U2GvqWlUrJA4119OQ51NJ9oxZI/view>

**Link to the Educational site of LNTU**, where distance courses of the Study program «Motor Vehicle Transport» are developed <https://mdl.lntu.edu.ua/course/index.php?categoryid=56>

**The topics of the 6 courses** Study programs «Motor Vehicle Transport» will be updated, and laboratory practices will be developed.

#### **Program description (master)**

**Field of knowledge:** 27 «Transport»

**Specialty** 274 « Motor Vehicle Transport»

**Level first** (master)

**Study program** « Motor Vehicle Transport»

**Type of diploma and scope** of the educational program: Master's diploma, single, 90 ECTS credits, study period: 1 years 4 months.

Education Programme «Motor Vehicle Transport» is accredited by the decision of the Ministry of Education and Science of Ukraine order of the Ministry of Education and Science of Ukraine from 08.01.2019 № 13. Certificate of Accreditation УД №03007528 s issued by the Ministry of Education and Science of Ukraine from February 07, 2019.

**Cycle / level:** HPK of Ukraine - 7th level / Master, FQ-EHEA- second cycle, EQF-LLL - 7th level.

**Prerequisites:** Bachelor's diploma. Admission conditions are determined by the "Rules of admission to the Lutsk national technical university.

**Teaching language:** Ukrainian.

**Objects of study:** life cycle processes, objects and technological processes of road transport.

**Training goals:** training of specialists capable of complex solution of complex theoretical and practical problems in the operation and repair of objects road transport using modern technologies.

**Theoretical content** of the subject area: sections sciences and technologies that study and combine connections and regularities in the theory.

**Concepts:** principles of application according to the purpose of operation and repair of road transport facilities.

**Methods, techniques and technologies:** collection methods, processing, interpretation of research results and modeling of processes in the field of automotive transport; methods and technologies of scientific production, design, organizational and management activity.





**Tools and equipment:** modern devices and devices for measuring physical quantities and parameters in order to obtain characteristics of objects road transport; physical samples and (or) layouts of road transport facilities; specialized software.

**Academic rights of graduates:** The possibility of continuing studies at the third level (educational and scientific) educational level, obtaining additional qualifications in the adult education system.

**The main focus of the educational program.** The educational program is focused on advanced mastering the management of operational life cycle of wheeled vehicles, their components parts.

**Features of the program.** Training of specialists capable of comprehensive solving complex theoretical and practical problems tasks for the operation and repair of facilities road transport through the participation of bidders higher education in project activity and team work.

**Link to the structure and description of the Study program «Motor Vehicle Transport»:**  
<https://drive.google.com/file/d/1YIcXY2T YYxpY0ZpQe0IkRq0-MKVH4Yr/view>

**Link to the Educational site of LNTU,** where distance courses of the Study program «Motor Vehicle Transport» are developed  
<https://mdl.lntu.edu.ua/course/index.php?categoryid=458>

**LNTU will develop and accredit Double Diploma study program "Motor transport engineering" in cooperation with UDJG.**

### **3.5 Existing Study Programs**

#### **3.5.1 Proposed modifications / additions**

In order to ensure the competitiveness of graduates on the global labor market, their contribution to the benefit of both the national and global automotive industry, as part of the implementation of the international project DIGITRANS (Digital transformation of HEIs education process in Ukraine and Moldova for sustainable engagement with enterprises / Digital transformation of the educational process of higher education institutions in Ukraine and Moldova for sustainable interaction with enterprises), financed by the European Union's European Executive Agency for Education and Culture, is proposed to implement the educational and scientific program "[Motor transport engineering](#)".

This program is planned to be developed together with Dunarea de Jos University of Galati (Romania) with the aim of introducing a double degree program within the proposed educational and scientific program.

The purpose of the educational-scientific program "Motor transport engineering" is to provide theoretical and practical training of specialists who would master special conceptual knowledge, including the ability to conduct their own scientific research based on modern scientific achievements in the field of design and operation of wheeled vehicles.

The scope of the educational and scientific program is 120 ECTS.

The term of study is 1 year 10 months.



### Comparison of master's educational programs in the «Automotive transport» specialty

#### «Dunarea de Jos» University of Galati, Romania

Educational programs for the implementation of the double diploma program

Professional Master Program: «**Advanced concepts in road vehicles design and operation**»

Specialty «**Automotive engineering**»

Level: **second (master)**

Duration: **2 years**

#### Lutsk National Technical University, Ukraine

Educational programs for the implementation of the double diploma program

Professional Master Program: «**Road transport engineering**»

Specialty «**Motor Vehicle Transport**»

Level: **second (master)**

Duration: **2 years**

#### The purpose of the educational program:

| UDJG   | LNTU  |
|--|---|
| Provide theoretical and practical training of specialists who would acquire specialized conceptual knowledge, including modern scientific achievements in the field of road vehicles design and operation. | Provide theoretical and practical training of specialists who would master special conceptual knowledge, including the ability to carry out their own scientific research based on modern scientific achievements in the field of design and operation of wheeled vehicles. |

| Type of educational activity UDJG              | ECTS | Semester of study | Type of educational activity LNTU                            | ECTS |
|--|------|-------------------|--|------|
| <b>Compulsory disciplines</b>                  |      |                   |  |      |
| CAD/CAM  | 6    | 1                 | Designing means and objects of road transport infrastructure | 6,0  |
| Basics of experimental research of automotive  | 4    | 1                 | Theoretical and experimental research of cars                | 4,0  |
| Special road transport                         | 4    | 1                 | Special road transport                                       | 4,0  |
| Electric and electronic systems for automotive | 4    | 1                 |  |      |
| Ethics and academic                            | 2    | 1                 | Intellectual property and                                    | 2,0  |



|  |       |     |   |                 |
|--|-------|-----|---|-----------------|
| integrity  |       |     | copyright   |                 |
| Practice I, II   | 10+10 | 1+2 | Practice  | 9,0 (9,0 + 0)   |
| Comfort systems for automotive                                   | 5     | 2   |   |                 |
| Current automotive diagnostic methods and technologies           | 5     | 2   | Technologies of car diagnostics                                 | 5,0             |
| Energy saving technologies in transport                          | 4     | 2   |   |                 |
| Advanced digital skills  | 2     | 2   |   |                 |
| Hybrid and electric vehicles                                     | 5     | 3   | Hybrid and electric cars  | 5,0             |
| Modeling and simulation of the operation of road vehicle systems | 5     | 3   | Modeling and simulating the operation of road transport systems | 5,0             |
| Welding technologies applied in the automotive industry          | 5     | 3   | Welding technologies used in the automotive industry            | 5,0             |
|  |       | 1   | Problems of the theory and practice of motor vehicle management | 3,0             |
|  |       | 1+2 | English by professional direction                               | 7,0 (3,0 + 4,0) |
| Practice I, II   | 10+10 | 3+4 | Scientific practice   | (10,0 + 4,0)    |
| Elaboration of dissertation thesis                               | 20    | 4   | Elaboration of dissertation thesis                              | 20,0            |
| <b>Total compulsory disciplines</b>                              | 111,0 | -   |   | 89,0            |
| <b>Optional disciplines</b>                                      |       |     |   |                 |
|  |       | 2   | Electric and  | 5,0             |



|  |       |   |   |       |
|--|-------|---|---|-------|
|  |       |   | electronic systems for automotive         |       |
|  |       | 2 | Comfort systems for automotive            | 5,0   |
|  |       | 2 | Energy saving technologies in transport   | 5,0   |
|  |       | 4 | Management of processes in road transport | 3,0   |
|  |       | 4 | Alternative fuels                         | 3,0   |
| Recycling of used vehicles                                 | 4,0   | 2 | Ecology of road transport                 | 5,0   |
| Modern materials used in the construction of road vehicles |       |   |   |       |
| Vehicle safety systems                                     | 5,0   | 3 | Vehicle safety systems                    | 5,0   |
| Vehicles with hydrogen                                     |       |   |   |       |
| <b>Total optional disciplines</b>                          | 9,0   | - |   | 31    |
| <b>TOTAL ECTS</b>  | 120,0 |   |   | 120,0 |

### Study plan for students of LNTU

| Course group                   | ECTS       |
|--------------------------------|------------|
| Courses at LNTU                | 70         |
| Courses at DJUG                | 30         |
| Master thesis at LNTU and DJUG | 20         |
| <b>Total</b>                   | <b>120</b> |

| <b>SEMESTER 3 – Courses at DJUG</b>                              | <b>30</b> |
|--|-----------|
| Practice   | 10        |
| Hybrid and electric vehicles                                     | 5         |
| Modeling and simulation of the operation of road vehicle systems | 5         |
| Welding technologies applied in the automotive industry          | 5         |
| Vehicle safety systems   | 5         |



|  |                   |
|--|-------------------|
| <b>SEMESTER 4 – Courses at LNTU and DJUG</b> | <b>20</b>         |
| Elaboration of dissertation thesis           | 10 LNTU + 10 DJUG |

**SWOT analysis**

| Strengths sides   | Weak sides   |
|---|--|
| 1) The presence of highly professional teachers, 100% of whom have scientific degrees and titles, national and international awards, many years of experience working with students, possess modern educational technologies, and have numerous scientific publications in leading international electrical engineering journals. | 1) Martial law in Ukraine, which leads to an outflow of personnel and potential entrants.  |
| 2) There is a significant demand for specialists in road transport, which is confirmed by constant checks of employers, almost 100% employment of graduates of educational programs "Automobile transport", in particular at the master's level.  | 2) Missile attacks on the territory of Ukraine by the Russian Federation cause risks associated with the destruction and destruction of infrastructure |
| 3) Students constantly take part in competitions of scientific works of various levels, where they demonstrate high results.  |  |

As part of the current educational programs, 6 courses and laboratory practicums will be developed and modernized for bachelor's and master's students

| Study program/<br>Course /Lab title  | Updated or<br>new | Level:<br>Bachelor,<br>Master,<br>other | ECTS<br>credit<br>points | Mandatory<br>or elected<br>course | Teaching/training<br>methodologies<br>developed/adopted |
|--|-------------------|---|--------------------------|-----------------------------------|---|
| <b>Lutsk National Technical University, LNTU</b>   |                   |   |                          |                                   |   |
| Name of a study program, speciality:<br><b>Specialty:</b> 274 Motor Vehicle Transport (0716 Motor Vehicles, Ships and Aircraft)<br><b>Educational program: Motor Vehicle Transport</b> |                   |   |                          |                                   |   |
| Theory of operational properties of the car  | updated           | Bachelor                                | 7                        | mandatory                         | Lecture, practicals, lab practicals, tests              |
| Road transport enterprises. Part 1. Design   | updated           | Bachelor                                | 7                        | mandatory                         | Lecture, practicals, tests                              |
| Road transport enterprises. Part 2. Organization and management  | updated           | Bachelor                                | 5                        | mandatory                         | Lecture, practicals, tests                              |



| Study program/<br>Course /Lab title   | Updated or<br>new | Level:<br>Bachelor,<br>Master,<br>other | ECTS<br>credit<br>points | Mandatory<br>or elected<br>course | Teaching/training<br>methodologies<br>developed/adopted |
|---|-------------------|---|--------------------------|-----------------------------------|---|
| Road transport enterprises. Part 3. Quality of production processes   | updated           | Bachelor                                | 5                        | mandatory                         | Lecture, practicals, tests                              |
| Technical operation of cars   | updated           | Bachelor                                | 9                        | mandatory                         | Lecture, practicals, lab practicals, tests              |
| <b>Specialty:</b> 274 Motor Vehicle Transport (0716 Motor Vehicles, Ships and Aircraft)<br><b>Educational program:</b> Road transport engineering |                   |   |                          |                                   |   |
| Management of transport processes   | new               | Masters                                 | 5                        | mandatory                         | Lecture, practicals, tests                              |

### 3.5.2 Justification of proposed modifications / additions

Given the constant development of the automobile industry and technology, there is an increased demand for qualified engineers capable of working in the field of automobile transport. Introduction of new technologies in the automotive industry, including electric and autonomous vehicles, improving the designs of existing vehicles, introducing new approaches to the functioning of road transport enterprises, improving production processes, increasing attention to environmental issues and constantly increasing the requirements of environmental standards, requires specialists who have specific knowledge and skills.

Expanding the scope of educational programs also contributes to increasing the volume of scientific research in the field of road transport. This can lead to the opening of new opportunities for innovation and technological improvement in the field of road transport.

All these factors indicate that the opening of the educational and scientific program "Engineering on automobile transport" is appropriate for meeting the needs of the modern labor market and stimulating innovations in the field of automobile engineering.

### 3.6 Digital and labs resources for the integration into Digital Learning Ecosystem of DIGITRANS

LNTU uses the Moodle platform and ELECTUDE e-learning system during the educational process. During the pandemic caused by the COVID-19 coronavirus, the university actively developed a distance learning system using the Moodle platform, and after the start of the war in 2022, the ELECTUDE electronic learning system was implemented as part of the "Automotive Transport" educational programs. Since 2023, the active implementation of the platform, which is used to manage CARBOOK car service stations, has begun. This educational program uses Solidworks and ProEngineer software to design vehicles and facilities and their infrastructure.





As part of the implementation of the DIGITRANS project, LNTU plans to purchase the following equipment:

- Multi-make diagnostic motor scanner - 1 pc.
- Multi-make automotive diagnostic motor tester - 1 pc.
- Multi-channel (8-channel) oscilloscope – 1 pc.
- Interactive multimedia board with a projector - 1 pc.
- Laptop – 3 pcs.
- Web camera – 10 pcs.;
- Complex for determining the dynamic characteristics of cars while driving - 1 pc
- Automotive diagnostic educational stand - 1 pc.

The specified digital infrastructure and laboratory resources are planned to be integrated into the DIGITRANS digital learning ecosystem

### **3.7 Motivation for project development**

The DIGITRANS project is aimed at increasing employment opportunities for graduates, supporting sustainable growth and creating jobs in Ukraine and Moldova by implementing supporting measures:

- integration of research and training in such a way that students have the opportunity to conduct research at partner universities and enterprises. Introduction of integrated thematic complexes that will enable students to achieve additional learning outcomes;
- the development of innovative educational programs related to the ecological and energy-efficient mode of electrical engineering, information and computer systems, cyber security, automatic control techniques, electrical and electronic equipment, engineering and management in road transport, electric vehicles, automobile construction, as well as the necessary competencies of end-to-end skills and knowledge of entrepreneurship;
- development and implementation in the educational process of double degree programs between European and Ukrainian, Moldovan universities;
- introduction of innovative practical training schemes closely related to business, for example, internships, professional courses at enterprises, etc.
- digitalization of education with practical training of students in specific programs necessary for business, for example, special software for diagnostics, repair and maintenance of modern types of transport, etc.;
- development of virtual and remote practice (laboratory), such as classes for modeling, simulation, building and debugging models, etc.;
- development of a shared remote experimental environment as a digital distributed educational infrastructure supporting the digital learning ecosystem.
- development of an open interface for connecting the ecosystem of digital learning to the future Platform of Open Universities in Ukraine.
- enabling teachers and students fleeing Ukraine or internally displaced persons as refugees to be involved in the educational process through the DIGITRANS digital learning ecosystem.

Implementation of the double diploma program "Motor transport engineering" within the framework of the DIGITRANS project will allow to achieve the goals of the DIGITRANS



project, to introduce a modern educational program at the National Technical University, considering the European experience, to strengthen cooperation with partners, to strengthen the integration of the education system of the National National Technical University and the EU education system.



## 4. Technical University of Moldova, UTM

### 4.1 Summary

The DIGITRANS project aims to increase graduates' employability, support sustainable growth and jobs at Ukraine and Moldova, in line with the Green and Digital transition, through implementation of supporting measures such as:

-an actively engage in research endeavors at partner universities and enterprises.

This approach not only enriches our academic experience but also provides hands-on exposure to real-world scenarios. Additionally, the introduction of integrated thematic complexes enhances the learning process, allowing students to achieve additional learning outcomes. These thematic complexes are carefully curated to cover diverse topics, fostering a comprehensive understanding of the subject matter and promoting a holistic educational journey. Through this innovative framework, students can bridge the gap between theoretical knowledge and practical application, preparing them for the dynamic challenges of the professional landscapes.

### 4.2 Brief Description of the Educational System

The Technical University of Moldova was established in 1964 as the Polytechnic Institute of Chişinău, as an education center with engineering and economic specialties transferred from the Moldova State University. The institution had begun its first academic year (1964 – 1965) with 5140 students (2085 of which were full-time students) within 5 faculties: Electrotechnics, Mechanics, Technology, Construction, and Economics. The academic staff included 278 teachers, out of which only 36 were holders of academic certifications and scientific titles.

Fast forward to the present, the Technical University of Moldova has evolved significantly. Currently, it boasts an enrollment of 11,500 students and offers an extensive range of courses in approximately 150 specialties and specializations, spanning across 11 faculties. This growth is indicative of the university's commitment to academic excellence and the diverse educational needs of its students.

Republic of Moldova is a landlocked country located in Eastern Europe. It is situated between Romania to the west and Ukraine to the north, east, and south.

The country has a diverse landscape, featuring rolling hills, plains, and the fertile valleys of the Dniester River in the eastern part of the country. The capital city of Moldova is Chişinău, which is also the largest city and the economic and cultural center of the country. The official language is Romanian language.

Moldova has a predominantly agricultural economy, with wine production being a significant industry. It is also one of the least economically developed countries in Europe. Moldova is a parliamentary republic with a multi-party system. Moldova has several historical and cultural landmarks, including monasteries, fortresses, and wine cellars. Popular destinations include Orheiul Vechi, a historical and archaeological complex, and Cricova, one of the largest wine cellars in the world.



Moldova's strategic location between Romania and Ukraine has shaped its history and culture, and the country continues to navigate its path as an independent nation in Eastern Europe.

The structure of higher education in the Republic of Moldova is determined in accordance with the Education Code of The Republic of Moldova No. 152 dated July 17, 2014.

The Higher Education System in the Republic of Moldova is structured into three levels, aligning with the principles of the Bologna Process:

### **1st cycle – Bachelor studies:**

Programs include both full-time and part-time options, with part-time studies requiring an additional year of commitment. Upon successful completion, graduates who have defended their final Graduation Thesis are awarded a Bachelor's degree in a specific field of study.

*\* ECTS - European credit and transfer system. The volume of one ECTS credit is 30 hours. The workload of one academic year in the full-time form of education is, as a rule, 60 ECTS credits.*

### **2nd cycle – Master studies:**

Master's degree programs are typically offered on a full-time basis and culminate in the defense of a Master Thesis. Graduates who successfully defend their Master Thesis are granted the Title of Master in the respective field of study and specialization, receiving a Diploma of Master.

The educational and professional Master's training program in Moldova typically comprises 90-120 ECTS credits, while the educational and scientific program encompasses 120 ECTS credits. Notably, the Master's educational and scientific program incorporates a research (scientific) component of at least 30 percent. This ensures a comprehensive and balanced curriculum that combines theoretical knowledge with practical and research-oriented elements, contributing to a well-rounded educational experience for students pursuing advanced studies at the Master's level.

### **3rd cycle – PhD studies:**

Doctoral degree programs involve extensive scientific research, professional engagement, and creative endeavors. The duration is three years for full-time studies and four years for part-time studies. The conclusion of doctoral studies involves a public presentation of an original Research Thesis, evaluated by an Accredited Scientific Committee. Successful candidates are conferred the title of PhD in a specific field of science or arts upon receiving a Doctoral Diploma. The volume of the educational component of the educational and scientific program for the preparation of a doctor of philosophy is 30-60 ECTS credits.

The academic year starts on the 1st of September and lasts up to the end of June (42 weeks), with holiday breaks in January and April/May.

Each academic year is divided into two equal semesters. Each semester consists of 15 full weeks of classes, followed by the examination session.

An academic year includes two examination sessions and practical trainings (internships).



The grading scale runs from 1 to 10. The minimal passing grade is 5. The marks have the following meaning.

### **4.3 Accreditation System**

Accreditation of educational programs in the higher education system of Moldova is a crucial process that ensures the quality and standards of academic offerings. The accreditation process is typically overseen by relevant authorities or accreditation bodies within the country.

Accreditation standards and criteria set the benchmarks that educational programs must meet. These standards may encompass aspects such as curriculum quality, faculty qualifications, facilities, student support services, and overall program effectiveness. Accreditation of educational programs in the system of higher education in Republic of Moldova is carried out by the Moldovan quality assurance agency that was established by Government Decision no. 652/2014 as the National Agency for Quality Assurance in Professional Education (ANACIP). Following a reform initiated in 2017, that included a series of organizational and content changes for many structures from various fields of public interest, including quality assurance, by GD no. 201/2018, the name of the ANACIP was changed to the National Agency for Quality Assurance in Education and Research (ANACEC). ANACEC is a legal public body, responsible for quality assurance in the field of education and research. In its areas of activity, the Agency collaborates with central and local public authorities, as well as with international bodies.

The Agency aims at ensuring the quality of services provided by institutions in the field of education and research, thus contributing to the fulfillment of the requirements of society and the labor market in the training of competent staff. The Agency stimulates the increase of the level of responsibility of the institutions in the fields of education and research towards the quality of the services provided.

#### *Duties of the Agency:*

- *quality assurance in general education;*
- *quality assurance in vocational education and training;*
- *quality assurance in higher education;*
- *evaluation of continuous professional training programs;*
- *evaluation of organizations in the field of research and innovation;*
- *evaluation of the scientific and scientific-didactic staff.*



*The Agency is entrusted with the following rights:*

- *to contribute to the improvement of the regulatory framework in its fields of competence;*
- *to request and receive, as prescribed by the regulatory framework, from central and local public authorities - information relating to its fields of competence necessary for performing its duties;*
- *to set up boards, committees, expert groups and other consultative platforms to carry out the tasks in its fields of competence;*
- *to form and participate in national and international projects in its fields of competence;*
- *to be a member of various international specialized organizations;*
- *to cooperate with similar agencies in other countries to develop and implement effective measures to improve the quality of professional training programs;*
- *to conclude, in the manner established by the regulatory framework, public procurement contracts;*
- *to involve evaluators in its areas of competence;*
- *to delegate expert evaluators to external quality evaluation missions;*
- *to verify, at the end of the evaluation mission, that the expert evaluators comply with the evaluation methodology applied;*
- *to exercise other rights under the normative acts regulating the relations in its fields of activity.*
- 

#### **4.4 Structure of BSc, MSc and PhD programs**

##### **Existing study Program description**

**Fundamental field of science, culture and technique:** “07 Engineering, manufacturing and construction”

**General field of study:** „071 Engineering and engineering trades”

**Professional training field:** "0713 Electricity and energy"

**Level first** (bachelor)

**Specialty:** 0713.3 " Electromechanics engineering."

**Type of diploma and scope** of the educational program: Bachelor's diploma, single, 240 ECTS credits, study period: 3 years 10 months.

Availability of accreditation: Certificate of accreditation of the study program 0713.3 "Electromechanical systems engineering ", valid until 16.05.2024.

**In 2024, it is planned to conduct the accreditation of the mentioned Study program.**

**Cycle / level:** ISCED - 6th level / Bachelor.

**Prerequisites:** Possession of a document on complete general secondary education or the educational and qualification level of a junior specialist, certificates of vocational training.

**Teaching language:** Romanian.

**Object of study and/or activity:** The aim is to train licensed engineers in electromechanics with competencies in the design, construction, and operation of machines and electrical drives, electromechanical systems for the automation of industrial and agri-





food technological processes, for electrical tools and equipment, medical and household technology, and electric transport. From the perspective of the curriculum, the specialization 0713.3-Electromechanical Systems Engineering has evolved considerably, considering the recent development of design, synthesis, and manufacturing technologies for electromechanical systems used in all fields of activity, as well as the development of training technologies, especially after the Republic of Moldova's accession to the Bologna Process.

The current state of electromechanical development in the context of national economic development requires the development of a new curriculum for the specialty 0713.3-Electromechanical Systems Engineering, considering its complex and multidisciplinary nature, which requires extensive knowledge and practical skills in the field of electrical engineering, electronics, information technologies, automation, and the automation of technological processes in various fields. The field of training requires the development and implementation of high-performance electromechanical and electrotechnological systems with high energy efficiency indices, the use of renewable energy sources (solar, wind, small rivers), the promotion of clean technologies, and environmental protection.

**Training goals:** To be up-to-date as an electromechanical engineer today, one needs to possess economic and managerial skills (organizing one's own business, acting as a manager-consultant in the field of electrotechnical products), be familiar with current policies in the field (National Program regarding the use of renewable energy resources and the energy efficiency of technological processes), be capable of organizing and leading a production or operation process of electrotechnical installations, autonomously and responsibly solve technical-economic problems, and be aware of the necessity of personal and professional development.

The structure and content of the study program are aligned with the policies and objectives of the Technical University of Moldova in the field of quality. The course/module units included in the curriculum are distributed in a logical sequence throughout the academic year, starting with fundamental ones and ending with those specific to the energy field, defining both transversal and professional competencies."

**Methods, techniques and technologies:** To develop these skills within the Electromechanical Systems Engineering Program, a wide range of methods, means, and forms of study are employed, involving a dedicated teaching staff. The curriculum includes both traditional courses and those focused on modern techniques and technologies. Theoretical material is reinforced through practical work, laboratory activities, internships, year-end projects, and thesis projects that focus on real-world issues of economic agents or research and development entities. The program also emphasizes the development of students' technical creativity and utilizes e-learning methods of instruction.

**The main focus of the educational program** and specialization. The appropriate application of fundamental knowledge in mathematics, physics, chemistry, materials, mechanical engineering, thermal engineering, electrical and electronic engineering in the field of engineering and engineering activities. Handling fundamental concepts from computer



science, information technology, modeling methods, simulation, identification, and analysis of processes and systems.

**Features of the program.** The qualification obtained after completing the first cycle - licensed engineer in electromechanics, is relevant for the job market and allows graduates to work as executive engineers in the design, development, manufacturing, and maintenance of equipment, machines, and electrical drives. It also enables them to implement electromechanical systems for the automation of technological processes.

**Link to the structure and description of the Study program:**

" Electromechanical systems engineering."": chrome extension://efaidnbnmnibpcjpcglclefindmkaj/https://utm.md/wp-content/uploads/2019/12/Plan\_FEIE\_EM\_FR-modif-2018.pdf

**Proposed modifications**

In the mentioned above study program will be updated three courses, laboratories and one new course will be elaborated. The courses can be seen in the table below.

|   | Study program/ Course /Lab title    | Updated or new | Level: Bachelor, Master, other | ECTS credit points | Mandatory or elected course | Teaching/training methodologies developed/adopted |
|---|-------------------------------------|----------------|--------------------------------|--------------------|-----------------------------|---|
| 1 | Digital control systems             | updated        | Bachelor                       | 5                  | mandatory                   | Lecture, practicals, lab practicals, tests        |
| 2 | Static power converters             | updated        | Bachelor                       | 5                  | mandatory                   | Lecture, practicals, lab practicals, tests        |
| 3 | Electrical and electronic equipment | updated        | Bachelor                       | 4                  | mandatory                   | Lecture, practicals, lab practicals, tests        |
| 4 | Electric vehicle Powertrain         | new            | Bachelor                       | 5                  | mandatory                   | Lecture, practicals, lab practicals, tests        |
|   |                                     |                |                                | <b>4/19</b>        |                             |   |



### Development and accreditation of a Double Diploma master study program.

UTM would like to develop and accredit Double Diploma master study program "Electric Vehicles and Energy-Saving Technologies" in cooperation with RTU.

The topics of the courses Study programs are mentioned in the below table (*it is not yet final version of the selected study programme*):

| o        | Code   | RTU Study Program                                    | TUM subjects (credit transfer plan) ECTS                     | (RTU) ECTS  |                                  |
|----------|--------|--|--|-------------|----------------------------------|
|          |        | <b>Compulsory study courses</b>                      |  | <b>64.5</b> |                                  |
|          | EEP584 | Theory of Electronic Converters of Electrical Energy | To be acquired at RTU  | 6           |                                  |
|          | EEP585 | Simulation of Electrical Processes                   | Modelling of electrical hydride vehicles                     | 7.5         | Transferred to RTU               |
|          | EEP574 | Commutated Converters                                | Converters and advanced electronic equipment                 | 7.5         | Transferred to RTU               |
|          | EEP572 | The Control Systems of Power Electronics Equipment   | Information technologies for vehicles                        | 7.5         | Transferred to RTU               |
|          | EEP570 | Elements of Automatics                               | Modern control systems in electric and hybrid vehicles (EVs) | 13.5        | Transferred to RTU               |
|          | EEP433 | Automated Electrical Drive                           | Traction motors for electric and hybrid vehicles (EVs)       | 4.5         | Transferred to RTU               |
|          | EEP524 | Design of Power Electronics Systems                  | To be acquired at RTU  | 4.5         |                                  |
|          | EEP504 | Microprocessors - based Automation Systems           | To be acquired at RTU  | 4.5         |                                  |
|          | EEP582 | Control Technique with Microprocessor Controllers    | To be acquired at RTU  | 4.5         |                                  |
| 0        | EEP583 | Industrial Frequency Converters and Inverters        | To be acquired at RTU  | 3           |                                  |
| 1        | IDA700 | Basics of Labour Protection                          | Civil Protection and Labour Protection in the Industry       | 1.5         | Transferred to RTU               |
|          |        | <b>Compulsory elective study courses</b>             |  | <b>21</b>   |                                  |
| <b>1</b> |        | <b>Field-specific study course</b>                   |  | <b>15</b>   | <b>B1 - Completed at Partner</b> |



|          |         |   |  |            | Institution                                  |
|----------|---------|---|--|------------|--|
|          | EEP408  | Automated Electrotechnological Processes                          |  | 3          |  |
|          | EEP430  | Industrial Programmable Control Systems                           |  | 3          |  |
|          | EEP 342 | Application of Computers in Electrical Equipment Design           |  | 3          |  |
|          | EEP 319 | Methods of Analysis and Calculation of Electronic Circuits        |  | 3          |  |
|          | EEP 458 | Typical Electrical Drive  |  | 7.5        |  |
|          | EEP 581 | Electro-Magnetic Compatibility in Industrial Electronic Equipment | Electrical Systems and Complexes of Vehicles             | 3          |  |
|          | EEP 453 | Industrial Electronic Equipment                                   | Mechatronic Systems for electric and hybrid vehicles     | 6          | Transferred to RTU                           |
|          | EEP 345 | Unconventional Systems of Energy Conversion and Accumulation      | Electric energy storage in electric and hybrid vehicles. | 4.5        | Transferred to RTU                           |
|          | EES 162 | High Voltage Engineering  | Power Electronics  | 4.5        | Transferred to RTU                           |
| <b>2</b> |         | <b>Humanities and social sciences study courses</b>               |  | <b>3.0</b> | <b>B2 - Completed at Partner Institution</b> |
|          | HSP483  | Industrial Relations  |  | 3.0        |  |
|          | HSP488  | Business Sociology  |  | 3.0        |  |
|          | HSP430  | Social Psychology   | Psychology of Conflict                                   | 3.0        | Previous education course transfer           |
|          | HSP446  | Pedagogy  |  | 3.0        |  |
| <b>3</b> |         | <b>Economics and management study courses</b>                     |  | <b>3.0</b> | <b>B3 - Completed at Partner Institution</b> |
|          | IUE217  | Business Economics  | Business Economics Management and project financing      | 3.0        | Previous education course transfer           |
|          | IUE308  | Entrepreneurship  | Research   | 3.0        |  |



|  |        | Planning                           | methodology and intellectual Property |             |                                      |
|--|--------|------------------------------------|---------------------------------------|-------------|--------------------------------------|
|  | IRO313 | Organization of Production         | Environmental Impact Assessment       | 3.0         |                                      |
|  |        | <b>Free elective study courses</b> |                                       | <b>6.0</b>  | C - Completed at Partner Institution |
|  |        | <b>Final examination</b>           |                                       | <b>30.0</b> |                                      |
|  | EEI002 | Master Thesis                      | Master Thesis                         | <b>30.0</b> | In cooperation with UTM              |
|  | EEL002 | Master Thesis                      |                                       | <b>30.0</b> |                                      |
|  | EEP002 | Master Thesis                      |                                       | <b>30.0</b> |                                      |

#### **4.5 Digital and labs resources for the integration into Digital Learning Ecosystem of DIGITRANS**

The Laboratory of Electromobility (UTM) has a class with equipment that can be integrated into the Digital Learning Ecosystem of DIGITRANS.

With the help of existing laboratory equipment and what is planned to be purchased under the DIGITRANS project, it is possible to carry out simulations of the flow of electrical processes, carry out their calculations, practical and laboratory classes.

The Laboratory of Electromobility technologies in transport TUM has such equipment that can be integrated into the Digital Learning Ecosystem of DIGITRANS:

##### 1) Lead acid Batteries training system

- The introduction of a specialized training system for lead-acid batteries will provide students with hands-on experience in understanding the principles, maintenance, and operational aspects of lead-acid battery technologies.

##### 2) Electric vehicle charging station

- The incorporation of an electric vehicle charging station is pivotal for exposing learners to the intricacies of EV charging infrastructure. This hands-on training opportunity will cover various charging protocols, safety measures, and the evolving landscape of electric vehicle charging technologies.

##### 3) Car train “Diagnosis and maintenance of a high voltage battery”

- This dedicated training module focuses on high voltage battery systems, offering students practical insights into the diagnosis and maintenance of advanced energy storage solutions. The integration of this training unit aligns with the industry's growing demand for skilled professionals in electric vehicle maintenance.

##### 4) Car train “Hybrid and Electric vehicle”



- The "Hybrid and Electric Vehicle" training module is designed to provide a comprehensive understanding of both hybrid and electric vehicle technologies. Students will engage in practical sessions covering the operation, maintenance, and diagnostic procedures specific to these innovative automotive platforms.

According to the DIGITRANS project, it is planned to purchase the following equipment, which will be part of The Laboratory Electromobility and will be integrated into the Digital Learning Ecosystem of DIGITRANS:

Complex for teaching and practical research:

- CompactRIO Controller is a deployable controller for data acquisition and control applications
- Current input module 3-Channel;
- Voltage module 3-Channel;

Oscilloscop 2 chanel 400VAC;

#### ***4.6 Motivation for project development***

Describe the incentives that led to the implementation of the project including in the discussion conclusions from the European experience and its contribution to DIGITRANS learning ecosystem implementation.

The implementation of the project is primarily driven by a combination of local and international incentives. At the national level, there is a recognition of the growing importance of digital transformation across various industries.





## 5. Alecu Russo Balti State University, USARB

### 5.1 Summary

The ex-ante report is a description of existing study programmes and current situation at Alecu Russo Balti State University (USARB) and Moldova's Educational System to facilitate the partners' understanding of the specifics of the university programs and the educational system in each country and to ensure good implementation of the DIGITRANS project.

The DIGITRANS project aims to increase graduates' employability, support sustainable growth and jobs at Ukraine and Moldova, in line with the Green and Digital transition, through implementation of supporting measures such as:

- Integration of research and training in such a way that students have the opportunity to conduct research at partner universities and enterprises. Introduction of integrated thematic complexes that will give students the opportunity to achieve additional learning outcomes.
- Development of innovative educational programs of electrical engineering, information and computer systems, cybersecurity, automatic control engineering, electrical and electronic equipment, engineering and management in road transport, electro mobiles, automotive manufacturing, as well as necessary competences of transversal skills and entrepreneurship knowledge aligned with the Green Deal and Fit for 55 EU strategic aims.
- Development and implementation of Double Diploma programs between EU and Ukrainian, Moldavian universities.
- Introduction of innovative practical training schemes in conjunction with relevant industrial partners, e.g., internship, professional courses at enterprises, etc.
- Digitalization of education with practical training of students in specific skills with increasing demand in the job market, e.g. specific software for diagnostics, repair and maintenance of a modern type of transport, etc.
- Development of virtual and remote practice (labs), e.g. classes for modelling, simulation, building and debugging models, etc.
- Developing Sharing Remote Experiment Environment as a digital distributed educational infrastructure supporting the Digital Learning Ecosystem.
- Developing an open interface for interconnection of Digital Learning Ecosystem and e-learning platforms of partners universities to the forthcoming Open University Platform in Ukraine.
- Providing an opportunity to academic staff and students fleeing from Ukraine or internally displaced as refugees to be involved in an education process through the Digital Learning Ecosystem of DIGITRANS.

### 5.2 Brief Description of the Educational System

The mission of Higher Education **in the Republic of Moldova:**

- creating, preserving and disseminating knowledge at the highest level of excellence;



- the training of highly qualified specialists competitive on the national and international labor market;
- creating opportunities for professional training throughout one's life;
- preservation, development and promotion of national cultural-historical values in the context of cultural diversity.

Higher education **in the Republic of Moldova** is structured in **three cycles**:

- Cycle I - higher undergraduate studies (ISCED level 6);
- Cycle II - master's higher studies (ISCED level 7), cycle I and cycle II - integrated higher studies (ISCED level 7);
- Cycle III - higher doctoral studies (ISCED level 8).

Higher education programs include educational and research activities or artistic creation, which ensure training in an advanced academic or professional field, in accordance with the normative framework in force.

**Forms of organization of higher education in the Republic of Moldova. Higher bachelor and master studies** are organized in the following forms of education:

- Full time studies;
- Part-time studies;
- Distance studies.

**Higher doctoral studies** are organized in the following forms of education:

- Full time studies;
- Part-time studies;
- Distance studies.

Higher education institutions have the status of **university autonomy**. University autonomy covers the fields of management, structuring and functioning of the institution, teaching and scientific research, administration and financing.

Citizens of the Republic of Moldova are guaranteed **access to higher education**:

- on places with funding from the state budget, within the limits established annually by the Government;
- on places with tuition fees paid by natural or legal persons;
- on places with mixed financing.

Higher studies are regulated by the **Nomenclature of professional training fields and specialties**. The nomenclature of professional training fields and specialties is a component part of the state educational standards and determines the fields and specialties based on which professional and scientific training is carried out in higher education. The nomenclature of professional training fields and specialties is approved by the Government, upon the proposal of the Ministry of Education and Research in agreement with the line ministries.

**Admission to higher education in the Republic of Moldova** is organized only at accredited or provisionally authorized study programs, in accordance with the law. The plan for admission to higher education with funding from the state budget is approved by the Government. The monitoring of admission to higher education is carried out by the Ministry of Education and Research.

**Duration of the academic year in the Republic of Moldova:**



- In the first cycle of higher education (bachelor's degree), the academic year consists of two relatively equal semesters, which include two exam sessions, internships and two vacations.
- The duration of a semester is on average 15 weeks of direct contact with students.
- The duration and duration of exam sessions, as well as the duration of vacations, are established by the higher education institution.

#### **The European Credit Transfer and Accumulation System (ECTS) in the Republic of Moldova:**

- The European Credit Transfer and Accumulation System (ECTS) is applied in the higher education system.
- Study credits measure the amount of work required by the student within a course/academic discipline during a unit of time to achieve the minimum level of the objectives and the programmed learning outcomes and are allocated as follows:
  - for one academic semester - 30 study credits;
  - for one academic year - 60 study credits.
- Higher education institutions can accept a maximum of 30 study credits accumulated in post-secondary and post-secondary non-tertiary professional technical education, based on the normative framework in force.

#### **Organization of study programs in higher education in the Republic of Moldova**

- **Cycle I - higher undergraduate studies** - correspond to a number of 180-240 study credits, 30 credits for each semester.
- **Cycle II - higher master's studies** - correspond to a number of 90-120 study credits, 30 credits for each semester.
- **Integrated higher education** - in integrated higher education, the cumulative duration of cycles I and II will correspond to a number of at least 300 study credits.

**Joint higher education programs** is a form of collaboration between two or more institutions jointly responsible for the development and approval of the bachelor's/master's/doctorate higher education program.

**Double majors** - within higher undergraduate studies, specialists can be trained in double majors only in the fields of educational sciences, sciences in the fields related to school subjects in general education and educational sciences, philology (combinations between two languages and literatures), arts and military. The way of establishing and organizing double majors is approved by the Ministry of Education and Research. The duration of studies for double majors in the first cycle of higher education is one year longer.

- **Cycle III - higher doctoral studies** - the higher doctoral studies programs correspond to a number of 180 study credits. Higher doctoral studies are carried out through three types of programs:
  - the scientific doctorate, which aims to produce original, internationally recognized scientific knowledge.
  - the professional doctorate, which aims to develop and innovate professional practices and is focused on applied research, including in the fields of arts and sports.
  - the industrial doctorate, which emphasizes the connection between the doctoral student, the higher education institution and the industrial environment.



**The postdoctoral programs** are organized for the purpose of carrying out fundamental and advanced applied scientific research, are intended for people with a doctor's degree and have a maximum duration of 3 years.

**In the Republic of Moldova**, higher education is organized and conducted based on **qualification standards and accreditation standards**:

- **Qualification standards** are developed and approved by the Ministry of Education and Research.
- **Accreditation standards** are drawn up by the National Agency for Quality Assurance in Education and Research, coordinated with relevant ministries and approved by the Government.

**The National Framework of Qualifications** in higher education ensures the transparency of higher education, academic mobility and the recognition of diplomas at the international level. The National Framework of Qualifications in higher education includes:

- description of professional training areas;
- description of qualifications and occupations;
- study objectives and learning outcomes (level descriptors for higher education cycles);
- the workload required for each study cycle, expressed in study credits;
- learning, teaching and evaluation methods;
- quality assurance procedures in higher education.

The National Framework of Qualifications in higher education is elaborated for each cycle of studies and field of professional training, in accordance with the European Framework of Qualifications and the need for qualifications on the national and European labor market.

**The curriculum in higher education in the Republic of Moldova** is developed in accordance with the provisions of the National Qualifications Framework, based on the qualification standards, for each study cycle and field, and is approved by the institution's senate.

### **Evaluation in higher education in the Republic of Moldova**

- The external evaluation of the educational process in higher education is carried out by the National Agency for Quality Assurance in Education and Research or other quality assessment agencies registered in the European Register for Quality Assurance.
- The internal evaluation of the educational process in higher education is carried out by the institutional quality assurance structures, based on an institutional regulation.

The learning outcomes of the students are evaluated:

- during the semester;
- at the end of the semester;
- at the completion of the study program within each cycle of higher education.

**Internships for students** from the **Republic of Moldova** are one of the mandatory forms of specialist training, organized by higher education institutions and carried out within institutions, organizations, companies, societies and other structures according to a framework regulation approved by the Ministry of Education and Research.



In higher education in the **Republic of Moldova**, in addition to the national grading system, the grading scale with qualifications recommended in the European Credit System for Education and Vocational Training (ECVET) is also applied (A, B, C, D, E, FX, F) to complete the diploma supplement and facilitate academic mobility. Equivalence with the national grading scale is done as follows:

- A: 9,01-10,0;
- B: 8,01-9,0;
- C: 7,01-8,0;
- D: 6,01-7,0;
- E: 5,0-6,0;
- FX: 3,01-4,99;
- F: 1,0-3,0.

In higher education **in the Republic of Moldova**, **management** is carried out on two levels:

- at national level - by the Ministry of Education and Research
- at the institutional level - by the management and administrative structures of higher education institutions.

**The system of governing bodies of higher education institutions in the Republic of Moldova** consists of the senate, the council for institutional strategic development, the scientific council, the faculty council, the administration council and the rector of the institution. The governing bodies of higher education institutions operate in accordance with the institutional regulation developed on the basis of the Framework Regulation on the establishment and organization of the governing bodies of higher education institutions, approved by the Ministry of Education and Research.

Public and private higher education institutions have their own patrimony, which they manage according to the law.

**Quality management** in higher education **in the Republic of Moldova** is ensured:

- at national level - by the Ministry of Education and Research and the National Agency for Quality Assurance in Education and Research;
- at the institutional level - of internal quality assurance structures.

A fully functional quality assurance system involves the completion of two successive stages:

- the provisional operating authorization, which represents the establishment act of the institution and grants the right to carry out the education process and to organize admission to studies;
- accreditation, which grants the right to organize the graduation exam, as well as the right to issue diplomas, certificates and other study documents recognized by the Ministry of Education and Research.

The staff of higher education **in the Republic of Moldova** consists of:

- scientific-didactic staff: university lecturer, associate professor, university professor;
- scientific staff: scientific researcher, senior scientific researcher, coordinating scientific researcher, main scientific researcher;
- teaching staff: university assistant, trainer, concertmaster, training foreman, coach;



- auxiliary teaching staff: librarian, computer scientist, methodical laboratory technician, accompanist;
- other staff categories: administrative and technical staff, secretary-referent, technician, engineer-technician, doctor, medical assistant, as well as auxiliary and service staff.

In higher education there are the following titles:

- scientific - PhD and doctor habilitatus;
- scientific-didactic - associate professor and university professor.

### **5.3 Accreditation System**

Higher education institutions in the Republic of Moldova are subject to external quality assessment once every 5 years, based on the methodology and criteria developed by the National Agency for Quality Assurance in Education and Research and approved by the Government.

Self-evaluation and internal evaluation of quality in higher education are carried out by the institutional structures responsible for quality assurance, in accordance with national reference standards.

The external assessment of quality in higher education is carried out by the National Agency for Quality Assurance in Education and Research or another quality assessment agency, registered in the European Register for Quality Assurance in Higher Education.

External evaluation for provisional operation authorization or accreditation of study programs in the Republic of Moldova

In higher education, the external evaluation of quality for the purpose of accreditation is done for each higher education program or for a group of higher education programs, but the accreditation of higher education bachelor's programs (cycle I), higher master's studies (cycle II), integrated higher studies is done for each program leading to a distinct university qualification.

The institutions of higher education in the Republic of Moldova cannot obtain provisional operating authorization or accreditation for master's and doctoral higher education programs (cycles II and III) if the higher education programs of the license (cycle I) in the same field are not accredited.

The external evaluation for provisional operation authorization or accreditation is triggered and carried out according to the methodologies developed by the National Agency for Quality Assurance in Education and Research and approved by the Government.

After obtaining the accreditation, study programs and higher education institutions are subject to periodic external evaluation, with a view to re-accreditation, at least once every 5 years.

In the case of obtaining negative results in the external evaluation of higher education institutions, the Ministry of Education and Research withdraws the right of activity of the institutions or organization of study programs, the students being assigned to similar programs in other educational institutions until the removal of the reasons based on the negative results of the assessment.





The decision regarding the provisional operation authorization, accreditation, non-accreditation or withdrawal of the right to operate a higher education institution or to organize a study program is adopted by the Ministry of Education and Research, based on the results of the evaluation carried out by the National Agency for Quality Assurance in Education and Research.

#### **5.4 Structure of BSc, MSc and PhD programs**

##### **Program description**

**Field of knowledge:** 071 Engineering and engineering trades

**Field of professional training:** 0710 Engineering and management

**Specialty** 0710.1 Engineering and management in automotive transport

**Level first** (bachelor)

**Study program** "Engineering and management in automotive transport"

**Type of diploma and scope** of the educational program: Bachelor's diploma, single, 240 ECTS credits, study period: 3 years 10 months.

Availability of accreditation: Certificate of accreditation of the educational program "Engineering and management in automotive transport ", valid until 26.05.2024.

**In 2024, it is planned to conduct the accreditation of the Study program "Engineering and management in automotive transport".**

**Cycle / level:** HPK of Moldova - 6th level / Bachelor, FQ-EHEA - first cycle, EQF LLL - 6th level.

**Prerequisites:** Possession of a Bacalaureat Diploma or an equivalent academic certificate; Diploma of vocational training; Diploma of Higher Education.

**Teaching language:** Romanian.

**Object of study and/or activity:** The purpose of the specialty is to train future licensed engineers with an integrated set of knowledge, skills and attitudes that will allow them to perform their duties and professional tasks at a qualitative level, i.e. the professional training of specialists for the concept of industrialization of products through classic, modern technologies, through the management and the management of material resources, manufacturing resources, company resources to ensure the competitiveness of products and the Company. This creates safe premises for the successful professional integration of graduates within the enterprises of the Republic of Moldova, as well as the possibility of professional achievement abroad.

**Training goals:** The acquisition of study objectives and the formation of skills is ensured by the educational content of the Education Plan. The aim of the university is to train responsible specialists, focused on innovation, professional growth and lifelong learning. In order to achieve this goal, the study program aims to achieve the following objectives:

- the training of engineers at a high level in the field of automobile construction capable of quickly integrating into the labor market, being competitive in a competitive environment, through their ability to adapt to changes and innovation;
- the formation of professional skills based on theoretical and practical training;
- the formation of research, creativity and innovation skills in the field of the automobile manufacturing industry.

**Programme outcomes and competences:**

**Professional competences:**





CP1. Carry out calculations, demonstrations and applications to solve the specific tasks of engineering and management based on knowledge from fundamental sciences.

CP2. Associate the basic knowledge, principles and methods of technical and economic sciences for the purpose of modeling and solving engineering problems, taking into account the saving of resources, labor and environmental protection.

CP3. Use the computer independently for modeling products, processes, phenomena, and automation of technical systems in special situations with the use of solutions known in new situations.

CP4. Develop the technological processes for the production of products in special situations using the solutions known to solve new problems.

CP5. Design industrial products to manage the processes of industrialization of the products and resources of the company in special situations with the use of solutions known in new situations

CP6. Plan, conduct and assure the quality of manufacturing processes, activating in the context of technical, economic, time, social, ethical, health, constraints, with the use of solutions known in new situations;

**Cross-disciplinary competences:**

CT1. Applying the rules of rigorous and efficient work, manifesting a responsible attitude towards the scientific and didactic field, for the optimal and creative capitalization of one's own potential in specific situations, respecting the principles and norms of professional ethics.

CT2. Carry out team activities effectively.

CT3. Identify lifelong learning opportunities and make effective use of learning resources and techniques for their own development.

**Academic rights of graduates:** The possibility of studying in the program of the second cycle of FQ-EHEA, level 7 EQF-LLL and level 7 HPK

**Features of the program.** The graduate can work as a quality engineer, mechanical engineer, production training engineer, sector foreman, section foreman, manager, teacher in vocational technical education.

**Link to the structure and description of the Study program "Engineering and Management in automotive transport":** <https://usarb.md/wp-content/uploads/2021/06/Inginerie-si-management-cu-frecventa.pdf>

**The topics of the 7 courses** from the study program "Engineering and Management in automotive transport" will be updated or developed, and laboratory practices will be developed and updated following the purchased equipment for the educational laboratory:

- 1) Automated laboratory complex on Modern vehicles;
- 2) Automated laboratory complex on Electric and Electronics for automotive industry;
- 3) Automated laboratory complex on Machine parts.

## 5.5 Existing Study Programs

**Field of knowledge:** 071 Engineering and engineering trades

**Field of professional training:** 0710 Engineering and management

**Specialty** 0710.1 Engineering and management in automotive transport



**Level first (bachelor)**

**Study program** “Engineering and management in automotive transport”

| No. | Course unit/ Module  | Code                      | Number ECTS credits | Form of control |
|-----|--|---------------------------|---------------------|-----------------|
| 1.  | Engineering and Economical Mathematics I                                     | F.01.O.001                | 6                   | E               |
| 2.  | Applied Physics  | F.01.O.002                | 4                   | E               |
| 3.  | Descriptive Geometry   | F.01.O.003                | 4                   | E               |
| 4.  | Study of Materials I   | F.01.O.004                | 4                   | E               |
| 5.  | Enterprise Economy   | F.01.O.005                | 4                   | E               |
| 6.  | German I   | G.01.O.006                | 4                   | E               |
| 7.  | Communication and Information Technologies                                   | G.01.O.007                | 4                   | E               |
| 8.  | Engineering and Economical Mathematics II                                    | F.02.O.009                | 6                   | E               |
| 9.  | Design of Machine Elements   | F.02.O.010                | 6                   | E               |
| 10. | Study of Materials II  | F.02.O.011                | 4                   | E               |
| 11. | Informatics  | F.02.O.012                | 4                   | E               |
| 12. | Technology of Materials I  | F.02.O.013                | 6                   | E               |
| 13. | German II  | G.02.O.014                | 4                   | E               |
| 14. | Technology of Materials II   | S.03.O.016                | 5                   | E               |
| 15. | Technology of Materials III / Logistics I                                    | S.03.A.017/<br>S.03.A.018 | 4                   | E               |
| 16. | Technical Mechanics I  | F.03.O.019                | 4                   | E               |
| 17. | Car  | F.03.O.020                | 4                   | E               |
| 18. | Electrotechnics  | F.03.O.021                | 5                   | E               |
| 19. | Mechanical technologies  | S.03.O.022                | 4                   | E               |
| 20. | Philosophical Issues of the speciality/<br>Philosophy and history of science | U.03.A.023/<br>U.03.A.024 | 4                   | E               |
| 21. | Technical Mechanics II   | F.04.O.026                | 5                   | E               |
| 22. | Quality Management / Logistics II  | S.04.A.027/<br>S.04.A.028 | 4                   | E               |
| 23. | Fundamentals of Electronics  | F.04.O.029                | 4                   | E               |
| 24. | Electrical Machines / Non Electrical Machines                                | S.04.A.030/<br>S.04.A.031 | 5                   | E               |
| 25. | Principles of Market Economy / Project management                            | U.04.A.032/<br>U.04.A.033 | 4                   | E               |
| 26. | European construction / European civilization                                | U.04.A.034/<br>U.04.A.035 | 4                   | E               |
| 27. | Machines and tools I / Scientific organization of work                       | S.05.A.036/<br>S.05.A.037 | 4                   | E               |
| 28. | Machine elements   | S.05.O.038                | 6                   | E               |



|     |   |  |            |   |
|-----|---|--|------------|---|
| 29. | Metrology and Standardization /<br>Production planning and management   | S.05.A.039/<br>S.05.A.040                | 4          | E |
| 30. | Fundamentals of Accounting  | F.05.O.041                               | 4          | E |
| 31. | Production management /<br>Business management  | S.05.A.042/<br>S.05.A.043                | 4          | E |
| 32. | Automatic Control Engineering   | S.05.O.044                               | 4          | E |
| 33. | Elements of public law /<br>Elements of private law   | U.05.A.045/<br>U.05.A.046                | 4          | E |
| 34. | Technical investment plan /<br>Acquisitions   | S.06.A.047/<br>S.06.A.048                | 4          | E |
| 35. | Electromobile /<br>Combustion engines   | S.06.A.049/<br>S.06.A.050                | 4          | E |
| 36. | Machines and tools II /<br>External economic relations, external trade<br>and customs services                  | S.06.A.051/<br>S.06.A.052                | 4          | E |
| 37. | Human Resources Management  | S.06.O.053                               | 4          | E |
| 38. | Moderation and presentation techniques.<br>Professional ethics and culture                                      | G.06.O.054                               | 4          | E |
| 39. | Cost Analysis and Estimation  | S.06.O.055                               | 4          | E |
| 40. | Automotive Electrical and Electronic<br>Equipment   | S.07.O.058                               | 4          | E |
| 41. | Automotive Engineering  | S.07.O.059                               | 4          | E |
| 42. | Enterprise Resource Planning Systems  | S.07.O.060                               | 4          | E |
| 43. | Automated Production Systems (SAP) /<br>Economic information systems 1C /<br>2D, 3D design of technical systems | S.07.A.061/<br>S.07.A.062/<br>S.07.A.063 | 5          | E |
| 44. | Energy Technique  | S.07.O.064                               | 4          | E |
| 45. | Automation in production /<br>Time management   | S.07.A.065/<br>S.07.A.066                | 5          | E |
| 46. | Work safety and health  | S.07.O.067                               | 4          | E |
| 47. | Environmental technique and protection  | S.08.O.068                               | 4          | E |
|     | <b>Total</b>  |  | <b>240</b> |   |

The education plan includes parts and components necessary for the training of the specialist according to the regulations in force: the fundamental component (F) - 74 ECTS credits, the general skills and competences training component (G) - 16 ECTS credits, the socio-humanistic orientation component (U) — 16 ECTS credits, the orientation component towards the basic specialty (S) — 98 ECTS credits. The total number of study hours provided in the plan — 7200, which is equivalent to 240 ECTS credits.

In the study process, the students complete a year's thesis (2 ECTS credits) which represents a separate entity in the educational plan.

Production practice I and II (8 credits), Documentation practice (12 credits) is carried out at factories, factories, etc. with which the Department of Physical and Engineering Sciences collaborates in order to train specialists in the field. These practices aim to deepen



and implement the theoretical knowledge accumulated during the semester or years of studies in the practical activity of organizations or companies in the field. The practice is preceded by an initiation conference and ends with a conference to summarize the practice by presenting the report in front of a committee established by the department.

The undergraduate internship is carried out in the VIII semester (8 ECTS credits) and is completed with prior support of the undergraduate thesis.

The studies are completed with the public defense of the bachelor's thesis. Graduates who have fully completed the stipulations of the education plan and who have successfully supported the preventive presentation of the bachelor's thesis are admitted to the defense of the bachelor's thesis.

The defense of the bachelor's thesis takes place publicly at the open meeting of the Bachelor's Commission. The title obtained at the end of the first cycle, higher undergraduate studies – Bachelor in engineering.

#### **5.5.1 Proposed modifications / additions**

7 courses and laboratory practicums for BSc level students will be developed and modernised for the study program “Engineering and Management in automotive transport” as follows:

| <b>Study program/<br/>Course /Lab title</b>    | <b>Updated<br/>or new</b> | <b>Level:<br/>Bachelor,<br/>Master,<br/>other</b> | <b>ECTS<br/>credit<br/>points</b> | <b>Mandatory<br/>or elected<br/>course</b> | <b>Teaching/training<br/>methodologies<br/>developed/adopted</b> |
|--|---------------------------|---|-----------------------------------|--|--|
| Automotive electrical and electronic equipment | updated                   | Bachelor  | 4                                 | mandatory                                  | Lecture, practicals, lab practicals, tests                       |
| Automatic control engineering                  | updated                   | Bachelor  | 4                                 | mandatory                                  | Lecture, practicals, lab practicals, tests                       |
| Electromobiles                                 | updated                   | Bachelor  | 4                                 | mandatory                                  | Lecture, practicals, lab practicals, tests                       |
| Automation in production                       | updated                   | Bachelor  | 5                                 | mandatory                                  | Lecture, practicals, lab practicals, tests                       |
| Autonomous vehicles                            | new                       | Bachelor  | 4                                 | elected                                    | Lecture, practicals, tests                                       |
| Hybrid vehicles                                | new                       | Bachelor  | 4                                 | elected                                    | Lecture, practicals, tests                                       |
| Engineering bionics                            | new                       | Bachelor  | 4                                 | elected                                    | Lecture, practicals, tests                                       |



### ***5.5.2 Justification of proposed modifications / additions***

The rapid development of the world economy sets requirements for increasing the quality and volume of transport services. In relation to this, given the fact that transport plays a significant role in the republic's economy, it is necessary to raise the level of training of personnel with higher education for this branch of the economy. The transformations in contemporary society also impose new rigors in the field of higher education, orienting the university axiological system towards training students in the capacities to think critically, learn and communicate effectively. The developed program represents the creative conception and industrialization of new products in the machine building industry, based on the symbiosis of the achievements of various fields – engineering, materials science, technology, economics – and oriented towards increasing their competitiveness and performance.

The specialty Engineering and management in automotive transport was opened at the proposal and in collaboration with the company "DRAEXLMAIER AUTOMOTIVE" S.R.L and with the University of Applied Sciences from Landshut (Germany), for the training of engineering-manager specialists in the field of activity of the mentioned company, but also with the support of other companies from the Balti Free Economic Zone (FEZ), such as: "GG Cables&Wires EE" S.R.L., "Elektromanufacturing" S.R.L., "SAROB Production" S.R.L., etc.

The training plan was developed through the collaboration of teaching staff from the Department of Physical and Engineering Sciences with managers from university institutions and companies, graduates of the faculty, students from higher years. Engineers, technologists, quality managers, as well as company directors (potential employers) were invited to the meetings to develop the plan in order to analyze the structure of the plan and the names of the course units. Focus groups were organized with the students and graduates of the specialty in order to identify the aspects for improving the study program. In order to increase the quality of studies in the field of engineering and management in automotive transport, the relevant Department organizes consultations with partners (potential employers, teaching staff from other higher education institutions, personalities in the field, graduates, students). At the University, Faculty and Department level, agreements are concluded with companies and relevant institutions.

The profile department constantly organizes scientific-didactic, methodical activities at the regional, national and international level in which potential employers, graduates and students involved in the study program Engineering and management in automotive transport participate.

The proposed modernization of 7 courses and laboratory practicums will improve the quality of the educational process and update the educational and material base for high-quality training.

All of this is to increase graduates' employability and support sustainable growth and jobs in Ukraine and Moldova, in line with the Green and Digital transition, through the implementation of supporting measures.

The purchase of equipment for educational laboratories and the development of modern laboratory workshops will allow students to have the opportunity to conduct



research at partner universities and enterprises. Introduction of integrated thematic complexes that will allow students to achieve additional learning outcomes.

### **5.6 Digital and labs resources for the integration into Digital Learning Ecosystem of DIGITRANS**

As part of the implementation of the DIGITRANS project, USARB plans to purchase the following equipment:

- Laboratory stand "Accumulators for electromobile" – 1 pc
- Laboratory stand "Chargers for electromobiles" – 1 pc
- Laboratory stand "On-board electric vehicle control system" – 1 pc
- Educational set "Electricity application for automotive industry" - 1 pc
- Educational set "Electronic application for automotive industry" – 1 pc
- Educational set "Sensors application for automotive industry" – 1 pc

### **5.7 Motivation for project development**

The main directions in the field of education, scientific research, innovation, development and technology transfer activities at USARB are stipulated in the Institutional Strategic Development Plan, approved in September of 2021, which set the following priorities: increasing the efficiency and competitiveness of the education process, strengthening the integration of USARB in the international space of higher education, increasing the importance and quality of research, development and technological transfer activities, strengthening the didactic and scientific potential of the University, development of research, innovation and technology transfer infrastructure, recruitment and professional development of the best specialists, etc.

In this context, USARB has good practices in developing the curriculum for the specialty "Engineering and management in automotive transport" in collaboration with CFC Draexlmaier and the University of Landshut, Germany within the DAAD international project. The needs of automotive companies in the North of the Republic of Moldova were analyzed in order to train specialists in this field. The basic problem that arose during the implementation of the education plan consists in the need to develop the infrastructure and equip the didactic and research laboratories with modern equipment to meet the needs of the learning process.

The demand for a workforce possessing competencies conducive to initiating and maintaining emerging environmental sectors, services, and methodologies is advocated by the worldwide imperative for sustainable progress. Successfully tackling the global challenges associated with the shift to low-carbon energy, encompassing energy security, accessibility, and affordability, necessitates the involvement of inventive approaches rooted in education and research across various industries. Additionally, in the age of the "digital revolution," all strategies and resolutions must be synchronized with contemporary digital and information and communication technology (ICT) tools.

At the same time, due to the constantly growing number of hybrid and electric cars, which require a completely new approach to the development of infrastructure for maintenance and repair work, there is a need to develop and revise curricula in the automotive industry.



The constantly growing number of hybrid and electric vehicles requiring a completely new approach to the development of infrastructure for maintaining and repair work proves this fact. This approach should be based on the implementation of contemporary, innovative energy-saving (ES) and EE systems, that will contribute to achieving main goals of DIGITRANS Project.

The DIGITRANS project will incorporate innovative teaching and learning methods, foster active collaboration with the business and research sectors, organize ongoing educational programs within enterprises, and enhance the capacities of HEIs in Moldova and Ukraine, particularly focusing on electrical engineering, information and computer systems, wireless networking technologies, cybersecurity, automatic control engineering, electrical and electronic equipment, engineering and management in road transport, electro mobiles, and automotive manufacturing.

The DIGITRANS project will also catalyze institutional reforms by bolstering digital skills and modernizing university services. This involves fortifying quality assurance processes, tools, and methods for the professionalization and development of academic, technical, and administrative staff.

Emphasizing the paramount importance of digital transformation, the DIGITRANS project will foster connections between education, research, and industry within the realm of digitalization. The initiative will develop solutions for digital skills, distance learning, and innovative teaching methods.





## 6. Cahul State University B.P. Hasdeu, USC

### 6.1 Summary

Until the establishment of the Cahul State University "Bogdan Petriceicu Hasdeu", in 1999, the youth went to the universities in Chisinau or in Romania, and only 10% of those who went to study returned to the South Region. Towards 1999, there was a gap and a shortage of specialists, especially in the field of engineering and mechanics. It was found that at that time the youngest specialist was 46 years old, so there is a generation gap of engineering specialists. Starting from 2008, the Cahul State University "B.P. Hasdeu" began to train engineers for the needs of companies in the south part of the republic by launching the education programs in engineering: Engineering and Management in Transport (2008), Engineering and Management in Food Industry (2010), and since 2018, has been authorized and the Engineering and Management in Machine Construction (Automotive) program.

Although the Engineering and Management in Machine Construction (Automotive) program was authorized in 2018, the first group was formed in 2022. Thus, at the moment there are only two groups, first year and second year.

Graduates of these degree programs can currently work at companies in the field of transport (auto depots), the food industry, the DRAXLMAIER company.

At the same time, the employers and the main investors in the south of the republic (DRAXLMAIER, FUJIKURA, FRITZMEIER) require specialists of management level and advanced specialization, especially in computer-aided mechanical engineering.

From the employers' requests, it is estimated that in the next 5 years for the 8 districts of the Southern Region of the Republic of Moldova, a need of approx. 140-160 specialists in computer-aided mechanical engineering, who will work in Comrat, Cahul, Vulcănești, Taraclia within the companies FUJIKURA, DRAXLMAIER, FRITZMEIER, in Giurgiulești International Free Port, Industrial Parks, ZEL where manufacturing companies with a high degree of technique and mechanical processes are located.

Due to the fact that, the Cahul city is considered the southern capital of the Republic of Moldova, the Cahul State University "B.P. Hasdeu" has a strategic geographical position. The Cahul city is part of the 8 districts of the Southern Development Region. According to the Regional Development Strategy, the main purpose of regional development is to raise the quality of life and increase the well-being of the inhabitants, and the results obtained in the implementation of the regional policy will contribute to the development of the regions and the country as a whole, this being also assumed by Cahul State University "B.P. Hasdeu". These objectives are included both in the National priorities and in the regional priorities.

The South Development Region, having a strategic position, managed to attract investors in the field of mechanical engineering throughout the territory of the South Development Region, such as DRAXLMAIER, FUJIKURA, FRITZMEIER. These investments are also due to the creation of free economic zones, which contributed to the creation of industrial parks. Of course, the need for qualified human resources in the field also appeared. Qualified specialists are provided by the Cahul State University "B.P. Hasdeu".



An important role in the Cahul State University "B.P. Hasdeu" development has close cooperation with a number of higher education institutions in the country and abroad. Currently, our university has signed cooperation agreements and partnerships with more than ten universities from Moldova, within Erasmus + Project, with universities from Romania, Ukraine, Poland, Turkey, Spain, Latvia.

According to our Strategy, internationalization plays an important role. The objectives of internationalization are evolving continuously, ranging from educating citizens everywhere and strengthening research capacities to increasing institutional prestige. At the same time, the new world of higher education is characterized by competition for prestige, talent and resources on both national and global scales.

The DIGITRANS project aims to increase graduates' employability, support sustainable growth and jobs at Ukraine and Moldova, in line with the Green and Digital transition, through implementation of supporting measures such as:

- Integration of research and training in such a way that students have the opportunity to conduct research at partner universities and enterprises. Introduction of integrated thematic complexes that will give students the opportunity to achieve additional learning outcomes.

- Development of innovative educational programs of electrical engineering, information and computer systems, cybersecurity, automatic control engineering, electrical and electronic equipment, engineering and management in road transport, electro mobiles, automotive manufacturing, as well as necessary competences of transversal skills and entrepreneurship knowledge aligned with the Green Deal and Fit for 55 EU strategic aims.

- Development and implementation of Double Diploma programs between EU and Ukrainian, Moldavian universities.

- Introduction of innovative practical training schemes in conjunction with relevant industrial partners, e.g., internship, professional courses at enterprises, etc.

- Digitalization of education with practical training of students in specific skills with increasing demand in the job market, e.g. specific software for diagnostics, repair and maintenance of a modern type of transport, etc.

- Development of virtual and remote practice (labs), e.g. classes for modelling, simulation, building and debugging models, etc.

- Developing Sharing Remote Experiment Environment as a digital distributed educational infrastructure supporting the Digital Learning Ecosystem.

- Developing an open interface for interconnection of Digital Learning Ecosystem and e-learning platforms of partners universities to the forthcoming Open University Platform in Ukraine.

- Providing an opportunity to academic staff and students fleeing from Ukraine or internally displaced as refugees to be involved in an education process through the Digital Learning Ecosystem of DIGITRANS.

## **6.2 Brief Description of the Educational System**

In the last decades, there have been several changes in the education system of varying degrees of complexity and influence on it:

- 1) the higher education system joined the Bologna Process (2005), which facilitated the alignment with European standards and the recognition of higher studies abroad;



- 2) the Education Code of the Republic of Moldova no. 152/2014, which opened new perspectives and created new opportunities for long-term education development;
- 3) started the implementation of the National Qualifications Framework, approved in 2017, correlated with the European Qualifications Framework (2008);
- 4) the concept of inclusion was promoted at all levels of the education system, ensuring the prerequisites for its realization in normative, methodological and human terms;
- 5) the coherent and unitary development of the National Curriculum was ensured through the development of the Reference Framework of the National Curriculum, the Reference Framework of Early Education, the Reference Framework of the Curriculum for Vocational Technical Education, the Reference Framework of the University Curriculum and the Reference Framework of education and extracurricular education.

In accordance with Article 12 of the Education Code of the Republic of Moldova, in the Republic of Moldova, with the changes of 2024 (№152 of 17.07.2014, version in force from 11.09.2020), the current structure of the Education System operates. The Education System is organized by levels and cycles in accordance with the International Standard Classification of Education (ISCED-2011):

- a) level 0 - early education:
  - preschool education;
  - preschool education;
- b) level 1 - primary education;
- c) level 2 - secondary education, cycle I: secondary education;
- d) level 3:
  - secondary education, cycle II: high school education;
  - secondary technical vocational education;
- e) level 4 - post-secondary professional technical education;
- f) level 5 - non-tertiary post-secondary technical professional education;
- g) level 6 - higher education, cycle I: higher education of license;
- h) level 7 - higher education, cycle II: higher master's education;
- i) level 8 - higher education, cycle III: doctoral higher education.<sup>3</sup>(fig.1)

The educational process is carried out on the basis of state educational standards, approved by the Ministry of Education and Research, regardless of the type of ownership and the legal form of organization of the educational institution.

The duration of the study year, internships, exam sessions and vacations is established for each level of education through the framework plan approved by the Ministry of Education and Research.

*The evaluation and marking process* is carried out in accordance with the regulation approved by the Ministry of Education and Research.

The evaluation of learning results, at all levels of education, is done with grades from "10" to "1" and, as the case may be, with the qualifications "excellent", "very good", "good", "satisfactory", "unsatisfactory", "admitted", "rejected" or by descriptors.

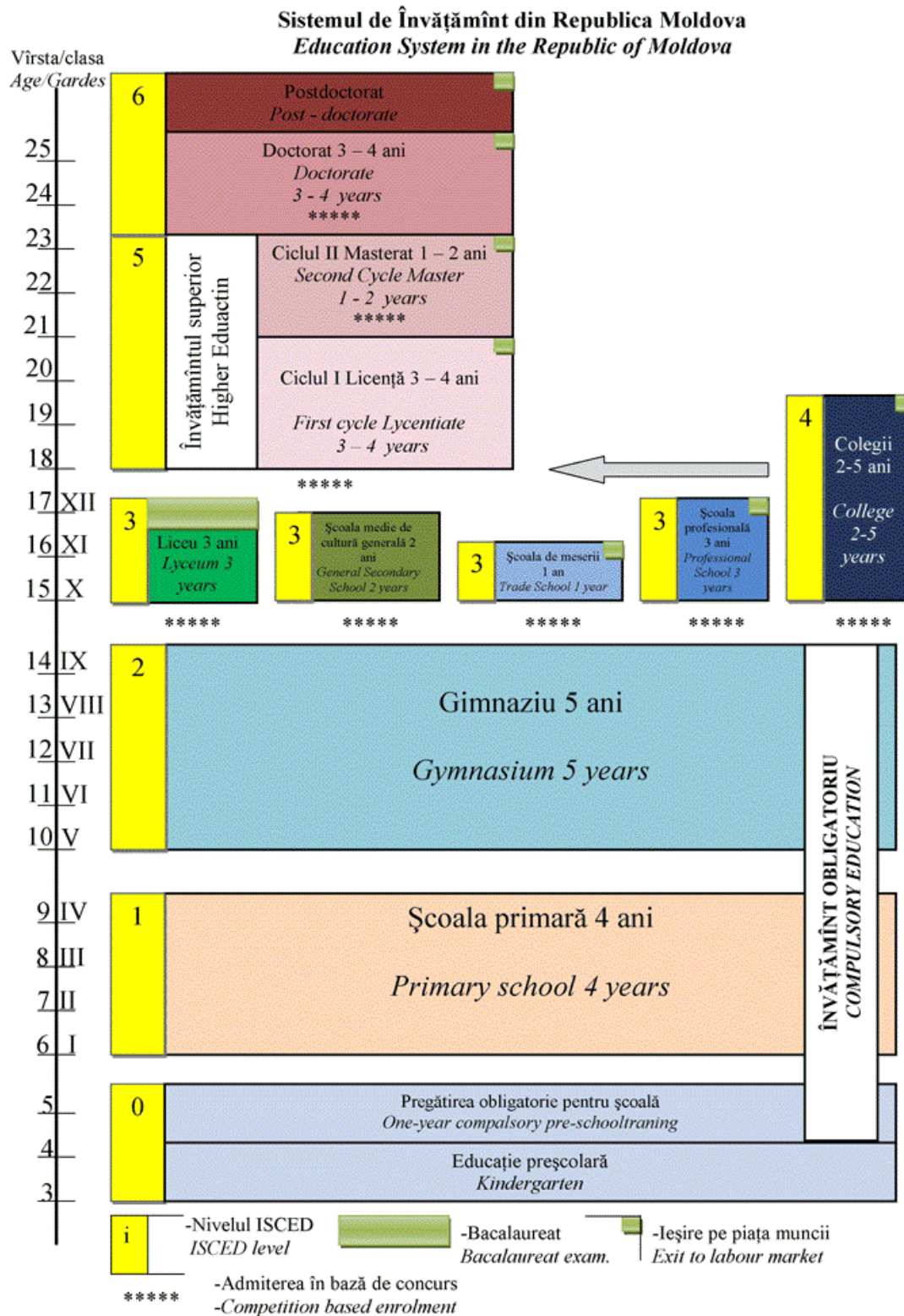
In primary education, the assessment of learning outcomes is criterion-based and is carried out through descriptors.

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<sup>3</sup> [https://lege.md/codul\\_educatiei/art-12](https://lege.md/codul_educatiei/art-12)



The evaluation and grading of students with special educational needs is carried out based on the individualized educational plans.







In higher education, in addition to the national grading system, the grading scale with qualifications recommended in the European Transferable Credit System (A, B, C, D, E, FX, F) is also applied to complete the diploma supplement and facilitate academic mobility. Equivalence with the national grading scale is done as follows:

- A: 9.01-10.0;
- B: 8.01-9.0;
- C: 7.01-8.0;
- D: 6.01-7.0;
- E: 5.0-6.0;
- FX: 3.01-4.99;
- F: 1.0-3.0.

Grading pupils and students without respecting the evaluation methodologies and national standards constitutes a disciplinary offense and is sanctioned according to the law.

*Higher education* in the Republic of Moldova is organized in universities, academies and institutes, both state and private institutions.

Higher education, with the exception of medical and pharmaceutical education, is carried out in two cycles:

cycle I – higher undergraduate studies;

cycle II – higher master's studies.

Higher studies correspond to a certain number of ECTS transferable study credits:

the duration of higher undergraduate studies is 3-4 years and corresponds to a number of 60 credits for one year of study;

the duration of higher master's studies is 1-2 years and corresponds to a number of 60-90-120 study credits.

Admission to higher education is carried out by competition, according to general criteria established by the Ministry of Education, respectively, at the first cycle - on the basis of the certificate of secondary studies of general culture, the baccalaureate diploma, the diploma of specialized secondary studies (college), and at the cycle II - based on the bachelor's degree (or equivalent).

In 2020, the "Higher Education in Moldova" Project was launched by the Ministry of Education and Research (MEC). The project is financed by the International Development Association and will be implemented between September 2020 and December 2025. The amount of credit granted to the Republic of Moldova for the implementation of the Higher Education Project in Moldova is 35.7 million. euro or the equivalent of 39.4 mln. US dollars.

The Development Objective of the Project is to improve the orientation towards the labor market of the selected higher education institutions and to improve quality assurance mechanisms

The project consists of the following components:

Component 1. Improving quality assurance mechanisms;

Component 2. Improving orientation towards the labor market through specific interventions;

Component 3. Project Management.

The strategic target areas of the Higher Education Project will be: programs with a pedagogical profile, engineering, information technologies, medicine.



The management of the education system is carried out at three levels: national, local and institutional.

### **6.3 Accreditation System**

Quality management in education in the Republic of Moldova is ensured:

a) in general education:

- at national level - by the Ministry of Education and Research and the National Agency for Quality Assurance in Education and Research (ANACEC);
- at the local level - by the local body specialized in the field of education;
- at the institutional level - by the managers of general education institutions;

b) in professional technical education and in *higher education*:

- at national level - by the Ministry of Education and Research, relevant ministries and the National Agency for Quality Assurance in Education and Research;
- at the institutional level - by the respective quality assurance structures in education.

The National Agency for Quality Assurance in Education and Research operates based on the regulation approved by the Government, under the conditions of this code.

ANACEC's duties regarding quality assurance in higher education provide:

- a) developing the methodology and external evaluation criteria for the authorization of provisional operation and accreditation of study programs and educational institutions superior and their presentation to the Ministry of Education and Research to be promoted for approval by the Government;
- b) developing the methodology for approving the right to lead doctorates and its presentation to Ministry of Education and Research to be promoted for approval by the Government;
- c) approving the methodology regarding the ranking of higher education institutions;
- d) approval of the procedure regarding the provisional operation authorization and accreditation a joint higher education program;
- e) evaluation of higher education institutions and study programs for the purpose provisional operation authorization or their accreditation;
- f) external evaluation of doctoral schools and their programs;
- g) approval or rejection of the request to become a doctoral supervisor as a result of a evaluating the files presented by interested candidates;
- h) the exercise of other powers arising from the provisions of the normative framework in the field of activity of the Agency.

A fully functional national quality assurance system involves the completion of two successive stages:

- a. the provisional operating authorization, which represents the establishment act of the institution and grants the right to carry out the education process and organize admission to studies;
- b. accreditation, which grants, in addition to the rights provided for in letter a), the right to organize the graduation exam, as well as the right to issue diplomas, certificates and other study documents recognized by the Ministry of Education, Culture and Research. Quality assessment in higher education consists of the multi-criteria examination of the



extent to which an educational institution and its study programs meet national reference standards.

To ensure the quality of study programs, Cahul State University has the Quality Management System, the Quality Manual, approved by the decision of the USC Senate, the Strategic Institutional Development Plan of the State University "Bogdan Petriceicu Hasdeu" from Cahul for the period 2022-2027, coordinated by USC Institutional Strategic Development Council. For quality assurance, USC applies seven system procedures and three specific procedures, structured in the Specific and System Procedures Manual. It also applies the Quality Assurance Procedure regarding the initiation, approval, monitoring and periodic evaluation of study programs (cycle I, II, continuing professional training), the Quality Assurance Procedure regarding the functioning mechanism of Juries (Analysis Commission) and the Procedure regarding the development of the Schedule of teaching activities.

#### **6.4 Structure of BSc, MSc and PhD programs**

Cahul State University "Bogdan Petriceicu Hasdeu" is a public institution that was founded on June 7, 1999, and its aim is to train and provide the southern region of the Republic of Moldova with highly qualified professionals. The University "B. P. Hasdeu" has three faculties:

1. Faculty of Economics, Engineering and Applied Sciences
2. Faculty of Humanities and Pedagogical Sciences
3. Faculty of Law and Public Administration and.

Although it has a short history, the University "B. P. Hasdeu" has registered very good results both in the domain of scientific research and in the involvement of teaching staff in the organization of different extracurricular activities, programs and projects, which has had the purpose to develop the educational domain in the southern region of the country. In this context, last few years were opened 11 master programs.

The material base of the university consists of: 2 study buildings blocks with 6 laboratories and 12 centers for scientific research, innovation and development, 10 multimedia rooms, the university library, the UN documentation and information center, the EU documentation and information center, Center of European studies and governance, Orange Free Wi-Fi zone, gyms, 2 dormitories. The library users also have free access to the Internet through their internal computer network, where the students have access to databases and electronic journals, purchased by the university' library.

The Faculty of Economics, Engineering and Applied Sciences, and trains professionals in the following fields:

1. at bachelor degree: Engineering and Management in Food Industry, Engineering and Management in Machine Construction (Automotive), Computer Science, Business and Administration, Accounting.
2. at master degree: Entrepreneurship and Business Administration, Financial-Accounting Management of the Business and Information Technologies for training.

Within the faculty there are two departments, the Department of Economic Sciences and the Department of Engineering and Applied Sciences. The faculty has the following facilities for carrying out the educational process: 12 classrooms, 2 IT labs, 1 lab for chemistry and microbiology, 2 labs for food technology, 1 lab for physics





The Higher Education System in the Republic of Moldova is structured on 3 levels (according to Bologna Process):

- 1<sup>st</sup>cycle – Bachelor studies
- 2<sup>nd</sup>cycle – Master studies
- 3<sup>rd</sup>cycle – PhD studies

Within the University, we have bachelor's and master's programs. We do not have a doctoral school, but we are in a consortium with the Universities of Moldova for managing doctoral students.

**Bachelor degree programs** (180-240 ECTS credits) are organized full-time and part-time. Part-time degree programs require one additional year of study. A Diploma of Bachelor is awarded to the graduates who have defended the final Graduation Thesis. Graduates are awarded the Title of **Bachelor** in a specific field of study.

**Master degree programs** (90-120 ECTS credits) are usually organized full-time and finalize with Master Thesis defence. Graduates who have successfully defended the Master Thesis are awarded the Title of **Master** in the field of study and the chosen specialization and are conferred a Diploma of Master.

**Doctoral degree programs** are carried out through comprehensive scientific research, professional activity and creative work, with a length of 3 years for full-time studies and 4 years for part-time studies. Doctoral studies finalize by a public presentation of an original Research Thesis, evaluated by an Accredited Scientific Committee. The holder of a Doctoral Diploma is awarded the PhD title in a particular field of science or arts.

## 6.5 Existing Study Programs

Since 2018, has been authorized the new **Bachelor degree programs (240 ECTS credits) - Engineering and Management in Machine Construction (Automotive)**.

This program was created and launched at the request of the DRAXLMAIER company.

Although the Engineering and Management in Machine Construction (Automotive) program was authorized in 2018, the first group was formed in 2022. Thus, at the moment there are only two groups, first year and second year.

### 6.5.1 Proposed modifications / additions

Within DIGITRANS projects, it will be developed and improved 6 courses and laboratory/ seminary works for students of bachelor degree, speciality „Engineering and Management in Machine Construction (Automotive)“



| <b>Cahul State University “Bogdan Petriceicu Hasdeu” – USC</b>                                     |  |                |                                |                    |                             |   |
|--|--|----------------|--------------------------------|--------------------|-----------------------------|---|
| <b>Specialty:</b> 0710 Engineering and management  |  |                |                                |                    |                             |   |
| <b>Educational program:</b> 0710.1 Engineering and Management in Machine Construction (Automotive) |  |                |                                |                    |                             |   |
| Nr   | Study program/ Course /Lab title   | Updated or new | Level: Bachelor, Master, other | ECTS credit points | Mandatory or elected course | teaching/training methodologies developed/adopted |
| 1.   | Design of electric machines  | updated        | Bachelor                       | 4                  | mandatory                   | Lecture, practicals, lab practicals, tests        |
| 2.   | Computer-aided design of products in the machine building industry       | updated        | Bachelor                       | 4                  | mandatory                   | Lecture, practicals, lab practicals, tests        |
| 3.   | Computer-aided design of technological processes and CALS technologies   | updated        | Bachelor                       | 4                  | mandatory                   | Lecture, practicals, lab practicals, tests        |
| 4.   | Tools of ecological production   | updated        | Bachelor                       | 4                  | mandatory                   | Lecture, practicals, tests                        |
| 5  | Planning and management of industrial enterprise (Production Management) | updated        | Bachelor                       | 6                  | mandatory                   | Lecture, practicals, tests                        |
| 6.   | Human resources management   | updated        | Bachelor                       | 4                  | mandatory                   | Lecture, practicals, tests                        |

The development and improvement of these courses and laboratory/seminary works are based on:

- the requirements of the companies;
- the training of qualified engineers for employment in the machine industry according to current requirements;
- the technological progress;
- the EU standards;
- online work.

### **6.5.2 Justification of proposed modifications / additions**

The university has a close collaboration and common learning activities with the University of Dunarea de Jos, Galati, Romania. As a member of a doctoral school's consortium of 5 universities of Moldova, the doctoral studies of USC are conducted by the allied HEIs from Chisinau.

Located in the small town on the board with Romania, the university is faced the problem of academic brain drain, which has historical background and causes the nearness of Romania, which give more opportunities for youth employment.

In the same time, Cahul State University B.P. Hasdeu has a strategic geographical position.



The Cahul district is part of the 8 districts of the Southern Development Region. According to the Regional Development Strategy 2022-2028, the main purpose of the regional development is to raise the quality of life and increase the well-being of the population, and the results obtained in the implementation of the regional policy will contribute to the development of the regions and the country as a whole, this being a desideratum assumed by CSU also. These objectives are part of both national priorities and regional priorities.

The DIGITRANS project will allow the mobility of teachers and students, which will increase the quality of the programs and the motivation of the teachers and students.

The new skills of university staff and students will help to strengthen the links with the regional businesses to increase the employability chances of graduates. The USC aims to strengthen learning and research capabilities in the field of Engineering, ICT, Economics sciences, Business, Entrepreneurship. The involvement of the business sector in university research is important both for university researchers and for enterprises. The university researchers will benefit from the improved interaction with companies, which will definitely provide more opportunities for research, the exploitation of research results at the technological level of the companies as well as creating opportunities for funding of industrial and research projects, e.g. by companies as well as potential investors, public authorities or national and international funding programmes.

The graduates will also benefit from increased interaction with companies, promising opportunities for placement and employability according to their university qualifications. On the side of the enterprises, the expansion of cooperation with universities promises opportunities for the settlement of innovative technologies and the creation of industrial projects. Thus, the companies will definitely benefit from the experience of working and interacting with the PC HEIs. The next important aspect is increasing the competence profile and skills of university graduates as potential future employers, the increased responsibility for work and its results will improve the corporate culture in the companies and thus spread it to other non-graduate employees.

## ***6.6 Digital and labs resources for the integration into Digital Learning Ecosystem of DIGITRANS***

The Faculty of Economics, Engineering and Applied Sciences within Cahul State University „Bogdan Petriceicu Hasdeu” has a computer lab for 20 places that can be integrated into the Digital Learning Ecosystem of DIGITRANS. This computer lab is used to perform the course and laboratory hours with the students that involve the use of the softwares for processing experimental data, computer-aided design, simulation of the behavior of materials or parts under certain loads, etc.

Also, the USC uses in the educational process the MOODLE institutional e-platform: <http://e-learning.usch.md/>, where the content of all courses and the tasks for seminars, practical, laboratory and individual works are placed. Within each course, a bank of questions can be created for student evaluation. Even if the Covid 19 pandemic period is over and courses are held through direct contact, USC teaching staff use this e-platform to facilitate students' access to all course materials at any time of need so that they can learn and carry out their laboratory or individual works.

Within the DIGITRANS projects, the acquisition of the following softwares is planned:



- **Matlab**, which is used for programming, 2D and 3D graphic representation, numeric and symbolic calculations, statistical and numerical analysis of experimental data, modeling and simulation of dynamic, hydraulic, physical, mechanical, electronic and other systems;
- **AutoCAD**, which is used to create accurate technical drawings, 2D and 3D models of machine components and assemblies, and technical documentation;
- **SolidWorks**, which is used for 3D modeling of machine components and assemblies, as well as modeling and analysis of their structural behavior before manufacturing;
- **Siemens NX**, which is used for 3D modeling, mechanical simulation, dynamic analysis, computer-aided manufacturing and product life cycle management.

These softwares will be used to develop students' practical skills in the design, analysis and development of automotive products, preparing them for employment and career advancement. Also, these softwares will be used for interdisciplinary projects due to study program, participation in student competitions and, also, for research and development projects.

### **6.7 Motivation for project development**

In recent years, the higher education sector has undergone major changes. A first change that was made in the higher education system in the Republic of Moldova is the implementation of the Bologna system. The Bologna Declaration of 1999 laid consolidated foundations for the realization of a Common Space of Higher Education in Europe by promoting common strategic directions at the national and institutional level (Education Code, 2014).

With the passage of time, the dynamics of higher education institutions in Moldova have undergone changes. In the last 12 years, there is a trend of reducing universities, from 33 institutions in 2011 to 24 institutions in 2022. State institutions have decreased from 19 units in 2010 to 16 in 2022, and the private ones have decreased from 14 institutions, in 2010, to 9 in 2022, or by 35%.

Analyzing the dynamics of students from the Republic of Moldova, enrolled in the period 2011-2022 in state universities, we notice a negative trend for the entire analysis period. Thus, if in 2010-2011 88,791 students studied in state institutions, then in 2014-2015 their number decreased by 18.4%, reaching 72,474 students, as in 2021-2022 their number to reach 57,228 students, registering a decrease of 35% compared to 2014-2015 and 36% compared to 2010-2011 (NBS, 2022).

In the period of 2010-2021, the dynamics of graduates of higher education institutions in Moldova registered a negative trend, from 28,408 graduates in 2010 to 24,274 graduates in 2015, to reach 14,084 graduates in 2021. This shows that the number of graduates decreased in 2021 by approximately 40% compared to 2015 and by approximately 50% compared to 2010.

Thus, a major problem is the brain drain from Moldova. The brain drain is reflected in the loss of human capital, which threatens the economic development, democratic consolidation and future of each country confronting the negative effects of this challenge. The tendency of academic brain drains, expressed in the massive exodus of the best



educated and highly qualified workforce overseas, is unfortunately characteristic of all countries of Eastern Partnership, among them Ukraine and Republic of Moldova.

The other negative side of academic brain drain is expressed in the vertical displacement of competent human capital to a less qualified professional environment, making the future innovative and technological development of the countries concerned questionable. The increased international academic and student mobility in recent years has had a positive effect on individuals, who benefit from working and studying in an international environment, gaining international experience, new skills and competences. However, the lack of job opportunities, lack of economic growth or necessary reforms at home lead to a loss of confidence in the economy and personal perspectives in own country, which results in an increasing number of potential migrants, seeking opportunities overseas. The shortage of competent and qualified labour leads to loss of innovative and technological potential, future entrepreneurs, failure of critical institutional infrastructure (health care, education, etc.), which exacerbates the problem of the country's economic development and future stability.

Despite rapid growth since 2000, Moldova remains one of the poorest countries in Europe and is confronted with the challenge of regional and social inequalities. The official data of the Bureau of Statistics of Moldova, show a figure of 72 372 Moldovan migrants working or seeking work abroad in 2020. For a country with about 2.6 Mio inhabitants, the loss of human capital of about 2.7% of the population is still a critical problem. The limited employment opportunities, lack of personal perspectives lead to an increase in migration, especially for youth. According to the IASCI study (2015), in Moldova 28% of all migrants have completed university-level education; 45% completed high school or vocational education.

Moldova is characterized by high levels of unemployment among young people, whereby the Bosnia-Herzegovina's youth unemployment rate of 25% in 2022 (Bureau of Statistics of Moldova) is among the highest in the world. The high level of brain drain remains a core problem. In the assessment of EU experts, this is mainly caused by the fact that investment in education is not fully transformed into the productive use of human capital. Therefore, the introduction of an innovative approach to activate young engineering and entrepreneurial to build up qualitative skills and competences at all HEIs is highly important. Although most PC HEIs have a high level of autonomy and flexibility in the study programme organization, the development of new curricula aimed at improving the employability skills, entrepreneurial, social and research skills of all target groups (students, academics, postdocs, employers) addressed in the project, will require the specific knowledge and expertise of PC (partner country) HEIs in terms of technology transfer, cooperation with the business sector and innovative collaborative learning methods. The existing institutional structures and processes need to be improved, particularly with regard to university-enterprises cooperation, to increase the innovative potential in the regions and employment prospects of graduates. Therefore, the support of the CBHE action is necessary to create the new opportunities and address the existing gaps in PC HEIs.



## 7. Brief analysis of Partners reports results

All partner Institutions offer study courses strongly related to the program, well aligned with the European Educational System.

The planned additions, modifications and updates to the curricula by the partners are well aligned with the objectives of the programme and adequately justified.

In addition, the planned digital learning ecosystem can potentially be used as a means of addressing difficulties that may arise due to the international situation in the partner countries, which makes it necessary -in case the existing computing infrastructure is deemed insufficient- to install a powerful server either in each of the partner institutions or in one in Ukraine and one in Moldova, in order to provide sufficient computing power to support DLE.

The following table summarises the modifications and/or additions proposed by each partner to the existing curricula.

| Partner | Modernisation activities in the study programs   | Notes                      |
|---------|--|----------------------------|
| CPNU    | Development of 3 new courses in a BSc program and update of 3 existing courses: 2 in BSc programs and 1 in MSc program   |                            |
| KhNAHU  | Modernisation of 7 courses and laboratory practicums in one study program;<br>Development of a bachelor's degree Double Diploma program  | In collaboration with RTU  |
| LNTU    | Development of 1 new study course in an MSc program; update of 5 existing courses in one study program;<br>Development and accreditation of a Double Diploma master study program. | In collaboration with UDJG |
| UTM     | Development of 1 new study course and update of 3 existing courses in one study program;<br>Development and accreditation of a Double Diploma master study program.                | In collaboration with RTU  |
| USARB   | Modernisation of 7 courses in one study program  |                            |
| USC     | Modernisation of 6 courses in one study program  |                            |

### Conclusions based on the surveys results

- The recorded competences and the current structure of the partners study programs demonstrate the readiness of the partner Universities to realize the improvements stated in the Project proposal to their programs.
- The overall structures of all the programs demonstrate their adequate flexibility for the expected modifications and/or additions which will bring them inline with the Bologna principles.
- The programs selected for modification/modernization are in line with the target and the scientific filed of the project; furthermore, the newly developed courses are well





in line with international practices the trends and current development of the digital transportation sector.

- The double diploma programs proposed for implementation are well in line with the project targets while effectively combine different principles to promote the subject of digital transportation and ensure an interdisciplinary approach in the educational system.
- Problems in the implementation of the programme might arise due to possible poor English language proficiency and lack of financing;
- The presence of many study courses of low ECTS value within one program could somehow complicate the students' mobility within the European Institutions.
- Accreditation is described as a quite strict procedure in both countries; therefore, partners are encouraged to get well prepared and schedule their submission in a timely manner with respect to the programme's duration.
- Nevertheless, as recorded in the individual reports, all partners are strongly motivated and have made the necessary preparations for the timely and proper implementation of the project.
- The opportunity provided to acquire or modernise equipment through the programme will greatly help to modernise curricula and bring them inline with the Bologna principles.
- The implementation of the planned study programs on the one hand will contribute to the modernization of curricula, on the other hand it will enhance the employability of students and will potentially be an incentive to limit the brain drain and the effects of the pandemic and the warship as recorded in the partners' reports.