

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
Ternopil Ivan Puluj National Technical University

EDUCATIONAL-PROFESSIONAL PROGRAM
«Mechanical Engineering»

of the second (Master's) level of higher education
on specialty 131 «Mechanical Engineering»
branch of knowledge 13 Mechanical Engineering
Qualification: Master of Science in Mechanical Engineering

Approved by the Academic Council

Head of the Academic Council

_____ / _____ /

(Protocol № 5 of 23.03 2021)

Educational program is launched since « _____ » _____ 20__

Rector

(Protocol № 47 of « _____ » 03 2021)



Ternopil 2021

Letter of Approval
of educational-professional program

Discussed and approved on the Mechanical Engineering Technology Department Meeting

Protocol № 6 of 19.02, 2021

Okipnyi I.B.

Head of the
Department


(signature)

Discussed and approved by the Academic Council of the Faculty of Engineering of
Machines, Structures and Technologies.

Protocol № 5 of 22.02, 2021

Head of the Faculty
Academic Council




(signature)

Leshchuk R.Y.

PREFACE

The educational-professional program (EPP) of Master's training on the specialty «Mechanical Engineering» includes 90 credits ECTS necessary to receive the proper level of higher education; the list of graduates' competencies; the required contents of undergraduates' training written in the terms of learning outcomes; forms of undergraduates' attestation; the requirements to the internal system of high education quality assurance .

The program meets the requirements of the Law of Ukraine «About Higher Education», Resolution of the Cabinet of Ministers of Ukraine of 29.04.2015 № «On Approval of the List of branches of knowledge and specialties under which the training of applicants for higher education is carried out», Order of MES of Ukraine of 06.11.2015 № 1151 «On Implementation of the List of branches of knowledge and specialties under which the training of applicants for higher education is carried out», Resolution of the Cabinet of Ministers of Ukraine of 30.12.2015 № 1187 «License conditions of educational activity in the educational institutions» and the project Standard of higher education of the second (Master of Science) level of branch of knowledge 13 «Mechanical Engineering» of the specialty «Mechanical Engineering», as well as foreign programs on the specialty «Mechanical Engineering» (access mode: <https://www.masterstudies.com/Masters-Degree/Technology-Studies/>).

The Program was developed by the work project group on the specialty 131 «Mechanical Engineering» consisting of:

1. Pylypets M.I. – D.Sc. in Engineering, Professor, Prof. of the Mechanical Engineering Technology Department – Head of the Program.
2. Vasylykiv V.V. – D.Sc. in Engineering, Professor, Prof. of the Mechanical Engineering Technology Department
3. Dyachun A.Y. – Ph.D. in Engineering Science, Associate Prof. of the of the Mechanical Engineering Technology Department
4. Shnitser Valerii – director of Repair mechanical plant «Obrii» (by agreement);
5. Kavunova Diana – student of the group MPM-51.

Reviews of external stakeholders:

1. Master of Science Training Program in Specialty 131 “Mechanical Engineering”

| Components | Description of the educational-professional program |
|---|---|
| 1 – General information | |
| Full name of higher educational establishment and a structural | Ternopil Ivan Puluj National Technical University Mechanical Engineering Technology Department |

| | |
|--|---|
| subdivision | |
| Full name of qualification | The second (Master of Science) level, Master of Science in Mechanical Engineering on the specialty 131 Mechanical Engineering |
| Program official name | Mechanical Engineering |
| Diploma type and number of credits according to the program | Master of Science Diploma (Single Honours), 90 credits ECTS, 1 year 4 months of study |
| Accreditation | Accreditation commission of Ukraine (National agency of higher education quality assurance), The Certificate of accreditation НД №2087425. Valid to 01.07.2024 |
| Cycle/level | FQ-EHEA – the second cycle, EQF LLL – 7 th level, HPK – 7 th level |
| Requirements | Bachelor degree or educational-qualification level «Specialist». The entrance requirements are specified by «Admission Rules of the Ternopil Ivan Puluj National Technical University» approved by the University academic council. |
| Language(s) of instruction | Ukrainian, English (some disciplines) |
| Educational program validity | Till next accreditation |
| Permanent Internet address of educational program description | http://tntu.edu.ua/storage/pages/00000484/op131m.pdf |
| 2 – Purpose of the educational-professional program | |
| Training of highly qualified specialists able to solve complex specialized tasks and practical problems of Mechanical Engineering characterized by complex and uncertain conditions. | |
| 3 - Characteristics of the educational-professional program | |
| Subject area | <p>The object of activity: structures, machines, equipment, mechanical systems and complexes, processes of the design, manufacture, study and operation;</p> <p>The goals of training: professional activity in the field of design, production, operation and scientific research of technical systems, machines and equipment, development of mechanical engineering technologies, teaching activity;</p> <p>Theoretical contents of the subject area: laws of mechanics and their applied applications, theoretical principles of design, analysis and optimization of structures and production technologies of machines, fundamentals of organization and conducting of scientific research of mechanical properties of materials, dynamics of machines and processes, machine parts and structures, modeling and forecasting of technical systems operating properties;</p> <p>Methods, techniques and technologies: analytical and numerical methods of design and calculation of machine and structures, mathematical and computer modeling and machines and mechanisms simulation; techniques and technologies of nature and virtual technological experiment; information</p> |

| | |
|---|--|
| | <p>technologies in engineering research, design and production;</p> <p>Tools and equipment: machine tools, instruments, technological and control devices, control-measuring information systems, hardware and software of research machine-tool and robotic-technical systems.</p> |
| Educational program orientation | Educational-professional academic. |
| Main focus of the educational program and specialization | <p>Special education in the field of Mechanical Engineering with possible acquiring the competencies for further professional, scientific or teaching career.</p> <p>Key words: engineering of machine-building technologies, generative design, optimization in production technologies, strength, endurance and safety of machines and structures.</p> |
| Specific features | Integration of general-technical, special technical and technological training for professional activity due to computer technologies in production engineering, technological, design, operation and repair services of production enterprises, workshops, shop floors providing a wide range of machinery production, technological equipment and facilities operation and servicing. |
| 4 – Graduates suitability for employment and further education | |
| Suitability for employment | Supervisors (other managers) and foremen of production operations (subdivisions) in industry; engineers in mechanical engineering; engineers (other fields of engineering); scientific researchers (applied mechanics); teachers of secondary educational establishments; lecturers of specialized educational establishments; lecturers of universities and other higher educational establishments. |
| Further education | It is possible to study on the program of the third (educational-scientific) level of higher education. |
| 5 - Teaching and Assessment | |
| Teaching and study | <p>Passive (explanatory-illustrative); active (problem, game, interactive, project, information-computer self-developing)- according to dominating techniques and ways of teaching.</p> <p>Group and integrative study – according to forms of organization.</p> <p>Positional and context study, collaboration technology – according to pedagogical cooperation orientation.</p> |
| Assessment | <p>Forms of term assessment: current control, self-control, exams, credits using the TNTU e-learning system Atutor. Students' progress in study is estimated according to 4-mark (“excellent”, “good”, ”satisfactory”, “unsatisfactory”) and verbal (“passed”, “not passed”) systems.</p> <p>Forms of control: oral and written questioning, tests, design projects, calculation-graph papers, term papers and projects, laboratory reports, presentations, reports on internship programs and scientific-research papers. The final attestation is in the form of a public defense of the Qualification paper which is checked for the plagiarism beforehand and is uploaded on the official site of the structural subdivision of the educational institution.</p> |
| 6 – Program competencies | |

| | | |
|---|--|--|
| Integral competence | Be able to solve complex tasks and problems in the field of applied mechanics or in the process of study characterized by uncertain conditions and requirements and involve the use of research and/or innovations implementation. | |
| General competencies (GC) | 3K1. | Be able to see, set and solve problems. |
| | 3K2. | Be able to make substantiated decisions. |
| | 3K3. | Be able to apply information and communication technologies. |
| | 3K4. | Be able to generate new ideas (creativity) and take measures on intellectual property protection. |
| | 3K5. | Be able to develop and manage projects. |
| | 3K6. | Be able to communicate with representatives of other professional groups (experts from other branches of knowledge/types of economic activity). |
| | 3K7. | Be able to study and acquire new knowledge. |
| | 3K8. | Be able to act on the basis of ethics thinking (motives) and the author's right. |
| | 3K9. | Ability of abstract thinking, analysis and synthesis. |
| | 3K10. | Be able to search, process and analyze information from different sources. |
| Special (professional) competencies (SC) | CK1. | Specialized conceptual knowledge of the latest methods and techniques of design and study of structures, machines and/or processes in the field of mechanical engineering. |
| | CK2. | Ability of critical analysis and forecasting the normal operation parameters of new and existing mechanical structures, machines, materials and production processes of mechanical engineering based on knowledge and use of modern analytical and/or computer-aided methods and techniques. |
| | CK3. | Use of proper methods and resources of modern engineering based on information technologies to solve a wide range of engineering problems using the advanced approaches, forecast methods realizing the solutions invariance. |
| | CK4. | Ability of critical substantiation of any problems in study, professional and research activity based on the latest achievements of engineering sciences and on the related subject areas. |
| | CK5. | Be able to set a problem and find ways of its solving by means of applied mechanics and related subject areas, knowledge of methods of the most efficient solution search under incomplete information and inconsistent requirements conditions. |
| | CK6. | Be able to use proper mathematical, scientific and technical methods, information technologies and applied computer software to solve engineering and scientific problems in applied mechanics. |
| | CK7. | Be able to describe, classify and model a wide range of objects and processes based on deep knowledge and understanding mechanical theories and practice as well as on the basic knowledge of related sciences. |
| | CK8. | Be able to generate new ideas and have skills in substantiating new innovative projects and assist their market promotion. |

| | | |
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| | CK9. | Be able to work independently or as a team or a structural subdivision manager while carrying out production operations, complex projects, scientific research. Bear responsibility for professional knowledge and practice, assessment of the team strategic development. |
| | CK10. | Be able to explain clearly personal conclusions, knowledge and ideas to specialists and non-specialists, especially in the teaching process. Be able to understand somebody's work, give and receive clear instructions. |
| | CK11. | Be able to carry out experimental research based on using the latest information technologies and hardware. |

7 – Program learning outcomes (PLO)

PPH1. Knowledge of methodology, methods and techniques of development and production of new kinds of products, especially at the stages of research-design works, and/or development of its production and renovation technological support.

PPH2. Knowledge of principles of automation systems construction and functioning of technological research, design and engineering analysis in mechanical engineering.

PPH3. Be able to perform modeling, static and dynamic analysis of structures, mechanisms, materials and processes on the stage of design using the latest computer systems;

PPH4. Theoretical knowledge and practical skills of using the advanced methods of the technical systems optimal parameters search by means of system analysis, mathematical, simulation and computer-aided modeling, under incomplete and inconsistent conditions in particular.

PPH5. Ability of critical thinking of the problems in professional activity and solving the innovative tasks set by oneself, be able to present scientific-technical developments (including Global network) and be able to substantiate and protect the obtained results and decisions made, especially in public.

PPH6. Be able to substantiate and assess innovative projects, knowledge of techniques of their market promotion, ability of econometric and scientific-metric assessment.

PPH7. Awareness of design principles, technological preparation, organization and control of mechanical engineering production using the advanced information systems and technologies;

PPH8. Awareness of fundamentals and ability of research and/or innovative activity conducting and of intellectual property protection; knowledge of principles of software and hardware functioning, information-measuring computer-aided systems of experimental study of mechanical systems and processes.

PPH9. Awareness of the higher education structure in Ukraine and abroad, specific scientific-teaching activity of a lecturer of a higher educational establishment, ability in using legislative and regulatory support, advanced means, methods and technologies of educational process organization implementation in profession-oriented courses teaching, use of various aspects of students' education in the field of engineering mechanics.

PPH10. Clear explanation of the conclusions made, knowledge and substantiation to specialists and non-specialists, whose who are studying in particular.

PPH11. Be able to make decisions under complex and unpredictable conditions requiring some new approaches use and forecasting.

PPH12. Responsibility for the development of professional knowledge and practical activity, assessment of the team strategic development.

PPH13. Ability of further learning, mostly autonomous and on one's own

8 – Program implementation resources

| | |
|---|--|
| <p>Staff assistance</p> | <p>According to staff assistance requirements to educational activity providing for certain level of HO (Appendix 2 to License terms and conditions), approved by the Resolution of the Cabinet of Ministers of Ukraine of 30.12.2015 № 1187 with amendments to the Resolution of the Cabinet of Ministers of Ukraine №347 of 10.05.2018.</p> <p>In particular, the program implementation is provided by highly qualified staff with scientific degrees and titles with great experience in teaching, pedagogical, scientific-research, managerial and innovative work in specialty. The academic staff involved in the teaching of profession-oriented disciplines has scientific degrees in specialty and approved level of scientific and professional activity. All lecturers are the authors of textbooks, monographs, articles, participants of national and international scientific conferences.</p> |
| <p>Materials and facilities</p> | <p>According to technological requirements to materials and facilities support of educational activity of certain level of HO (Appendix 4 to License terms and conditions), approved by the Resolution of the Cabinet of Ministers of Ukraine of 30.12.2015 № 1187 with amendments to the Resolution of the Cabinet of Ministers of Ukraine №347 of 10.05.2018.</p> <p>The specialized laboratories and computer classrooms of TNTU equipped with specialized software are used to conduct research.</p> |
| <p>Information support and teaching – learning materials</p> | <p>According to technological requirements to teaching methods and information support of educational activity of certain level of HO (Appendix 5 to License terms and conditions), approved by the Resolution of the Cabinet of Ministers of Ukraine of 30.12.2015 № 1187 with amendments to the Resolution of the Cabinet of Ministers of Ukraine №347 of 10.05.2018.</p> <p>Available:</p> <ul style="list-style-type: none"> - e-resources of teaching and learning materials of the courses (textbooks, teaching materials, lecture notes, study manuals); - periodicals; - E-archives of TNTU (monographs, articles, extended abstracts); - all library resources available via the university site, or in the library hall itself . <p>Teaching and learning materials of educational process are in the electronic repository of the university ELARTU, which is available: http://elartu.tntu.edu.ua/handle/123456789/8983. Electronic courses of the department are available for students in the system of electronic and distance learning ATUTOR: https://dl.tntu.edu.ua/browse.php?access=&category=22&speciality=0&search=&include=all&filter=Filter. The problem of providing students with textbooks and study guides is being solved by the department in two parallel ways: literature publishing by the department lecturers and their buying or subscribing by the university library. During their study the students are able to use special software to design buildings and facilities, mathematical processing of the research results. The teaching materials are constantly updating and adapting according to the stakeholders' preferences.</p> |
| <p>9. Requirements to the applicants</p> | |
| <ol style="list-style-type: none"> 1. Bachelor or Specialist degree is required. 2. Meeting other requirements specified by «Admission Rules of the Ternopil I.Puluj national technical university» approved by the University academic council.. | |
| <p>10 – Academic mobility</p> | |

| | |
|--------------------------------------|--|
| National credit mobility | <p>On the basis of the bilateral agreements signed by the Ternopil I.Puluj national technical university and other universities of Ukraine. Some individual agreements of academic mobility are possible aimed at study and research conducting at the universities and scientific institutions of Ukraine. Some leading specialists of the universities of Ukraine may be involved into the scientific work supervision of the applicants according to the individual agreement's terms.</p> <p>The credits received in other universities of Ukraine are validated according to the document of academic mobility.</p> |
| International credit mobility | <p>The bilateral agreements of scientific and academic cooperation have been signed by the Ternopil I.Puluj national technical university and educational establishments of countries-partners, agreements of international academic mobility. In particular, the agreements of scientific and academic cooperation have been signed with Wroclaw university of technologies (Poland), Zittau-Gorlitz university (Germany), Liberec technical university (Czech Republic), Dresden technical university (Germany). Since 2015 the cooperation has been maintained with Rotterdam university of applied sciences (the Netherland).</p> <p>Within the project Tempus Tacis JEP_26182_2005 «EU-UA Master Degree in Software Engineering» «European-Ukrainian Master Degree programme in Software» the agreed programs of Master's and Ph.D. training have been implemented, summer schools are held. Individual academic mobility is possible due to participation in the programmes of the project Erasmus + KA107 credit mobility with Svishtov Academy of Economics (Bulgaria), University of Southern Bohemia (Czech Republic). Competitive individual academic mobility is possible by the program EU Erasmus Mundus 545653-EM-1-2013-1-PL-ERA MUNDUS-EMA21 «Initiative of technical universities of Caucasus and Atlantic regions to provide high educational standards».</p> |
| Foreign students training | <p>Training is provided according to the standard terms or according to the individual schedule in a foreign language or in Ukrainian (after Ukrainian language course).</p> |

2. List of EPP educational components and their logical sequence.

2.1. List of educational components of EP

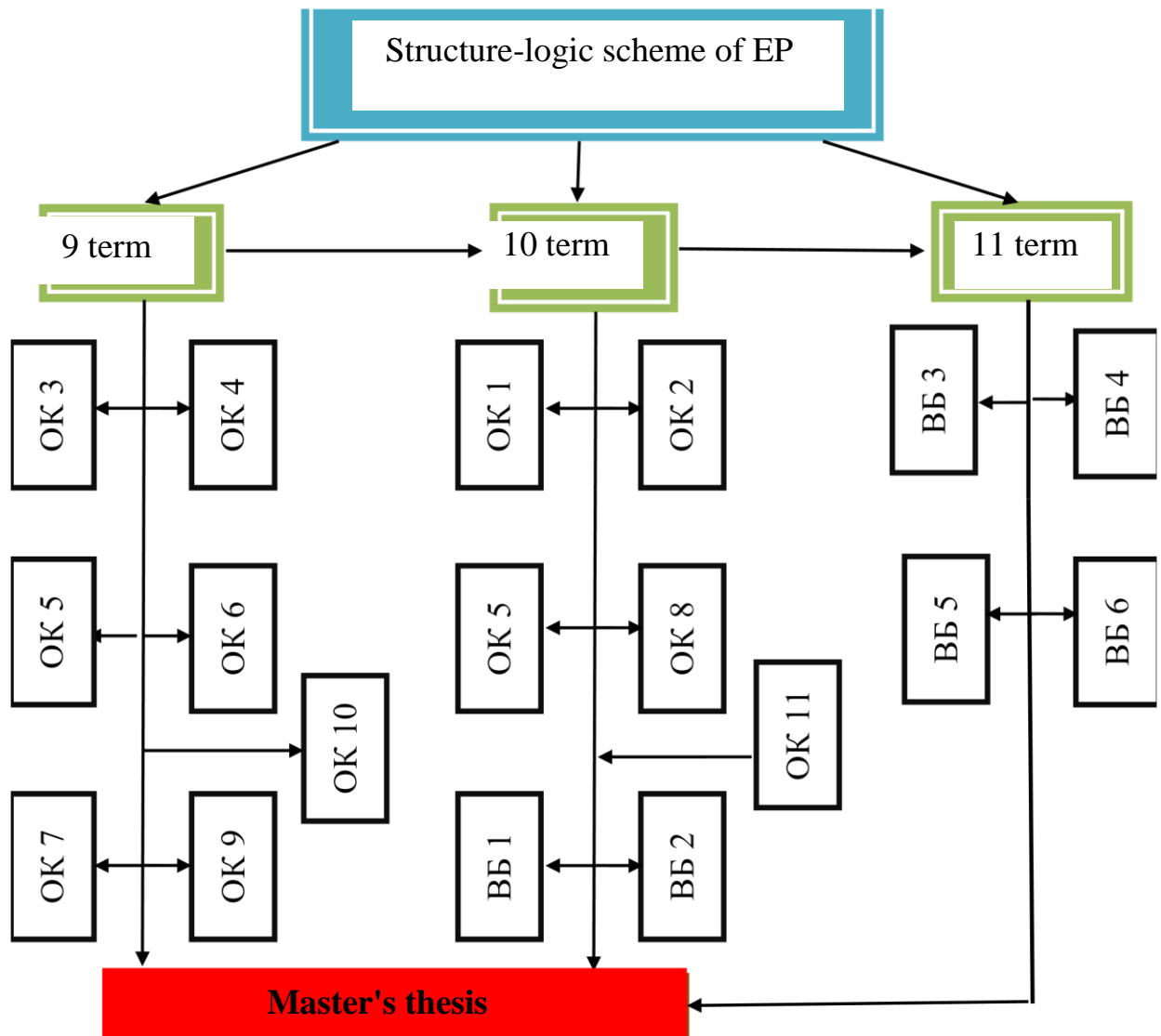
Table 2.1

Educational components of EP and their characteristics

| Code | Components of the educational program (academic disciplines, course projects (works), practices, qualification work) | Number of credits | Form of summary control |
|--------------------------------------|--|-------------------|-------------------------|
| 1.1. COMPULSORY COURSES of EP | | | |
| Cycle of general training | | | |
| OK 1. | Professional Ethics and Fundamentals of Pedagogy | 4,0 | credit test |
| OK 2. | Intellectual Property | 4,0 | credit test |

| | | | |
|---|---|---------------------|-------------------|
| OK 3. | Generative Design and Optimization in Production Technologies | 4,0 | credit test |
| Professional training | | | |
| OK 4. | Engineering of Machine Building Technologies | 4,0 | exam |
| OK 5. | Durability, Life and Safety of Machines and Structures | 8,0 | credit test, exam |
| OK 6. | Reliability of Machines | 4,0 | exam |
| OK 7. | Design of Manufacturing Engineering | 4,0 | exam |
| OK 8. | Process design and Industrial Engineering | 4,0 | exam |
| OK 9. | Fracture Mechanics of Materials and Structures | 4,0 | credit test |
| Practical training | | | |
| OK 10. | Specialty Practice | 9,0 | grading tests |
| OK 11. | Qualifying Paper-related Internship | 7,5 | grading tests |
| The total amount of compulsory components: | | 56,5 | |
| 1.2. OPTIONAL COURSES of EP | | | |
| 10 term | | | |
| ББ 1 | Course 1 from the list of elective disciplines | 4,0 | credit test |
| ББ 2 | Course 2 from the list of elective disciplines | 4,0 | credit test |
| 11 навчальний семестр | | | |
| ББ 3 | Course 3 from the list of elective disciplines | 4,0 | credit test |
| ББ 4 | Course 4 from the list of elective disciplines | 4,0 | credit test |
| ББ 5 | Course 5 from the list of elective disciplines | 4,5 | credit test |
| ББ 6 | Course 6 from the list of elective disciplines | 4,0 | credit test |
| The total amount of optional components: | | 24,5 | |
| Execution of master's thesis | | 7,5 | credit test |
| The total amount educational component of EP | | 88,5 credits | |
| Defense of master's thesis | | 1,5 | credit test |
| The total amount for master education | | 90,0 credits | |

2.2. Logic scheme of the structure of educational-professional program components study



3 Forms of attestation of the second (Masters's) degree of higher education

The Attestation of students majoring in 131 Mechanical Engineering takes place in the form of public defense of Qualification diploma paper and a standard document of the Master degree and the Qualification «Master of Mechanical Engineering » is awarded. The Attestation is open and public

4. Matrix of program competencies accordance to educational program components

| | OK1 | OK2 | OK3 | OK4 | OK5 | OK6 | OK7 | OK8 | OK9 | OK10 | OK11 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| 3K 1 | + | + | + | + | + | + | + | + | + | + | + |
| 3K 2 | + | + | + | + | + | + | + | + | + | + | + |
| 3K 3 | + | + | + | + | | | | | + | + | + |
| 3K 4 | + | + | + | + | + | + | + | + | | + | + |
| 3K 5 | | | + | + | | | | + | | | |
| 3K 6 | + | | | + | | | | | + | + | + |
| 3K 7 | + | + | + | + | + | + | + | + | + | + | + |
| 3K 8 | + | + | | | | | | | | | |
| 3K 9 | | + | + | + | | | | | | + | + |
| 3K 10 | | + | + | + | + | | | | + | + | + |
| CK 1 | | | + | | + | + | | | + | + | + |
| CK 2 | | | + | | + | + | + | | + | + | + |
| CK 3 | + | + | + | + | + | + | | | + | + | + |
| CK 4 | + | + | + | + | + | + | + | + | + | + | + |
| CK 5 | | | + | + | + | + | | + | + | | |
| CK 6 | | | + | + | + | + | + | + | + | | + |
| CK 7 | + | + | + | + | + | + | + | + | + | + | + |
| CK 8 | | + | + | + | | | | | | + | + |
| CK 9 | | + | + | + | | | | | + | + | + |
| CK 10 | + | | | + | | | | | | + | + |
| CK 11 | | + | + | | + | + | | | | | |

5. Matrix of program learning outcomes accordance (PLO) to educational program components

| | OK1 | OK2 | OK3 | OK4 | OK5 | OK6 | OK7 | OK8 | OK9 | OK10 | OK11 |
|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| ПРН 1 | | + | + | + | + | + | + | + | + | + | + |
| ПРН 2 | | | + | + | + | + | + | + | + | + | + |
| ПРН 3 | | | + | | + | | | | | + | + |
| ПРН 4 | | | + | | + | | | | | + | + |
| ПРН 5 | + | + | + | + | + | + | + | + | + | + | + |
| ПРН 6 | | + | + | + | | | | | | + | + |
| ПРН 7 | | | | + | | | + | + | | + | + |
| ПРН 8 | | + | + | | + | | | | + | | |
| ПРН 9 | + | | | + | | | | | | | |
| ПРН 10 | + | + | | + | | | | | | + | + |
| ПРН 11 | | | | + | + | + | | | | + | + |
| ПРН 12 | + | | | + | | | | | | + | + |
| ПРН 13 | + | + | | + | | | | | | + | + |

Head of educational program,
 Doctor of Science (Engineering), Prof. of the
 Mechanical Engineering Technology Department

Pylypets M.I.