



Modernization of technological equipment

Work program of the educational component (Syllabus)

Educational component details

Level of higher education	<i>First (bachelor's)</i>
Discipline	<i>13 - Mechanical Engineering</i>
Specialty	<i>133 Industrial mechanical engineering</i>
Educational program	<i>Engineering of equipment for the production of polymer and building materials and products</i>
Status of the educational component	<i>Selective</i>
Form of study	<i>full-time (day)</i>
Year of training, semester	<i>4 course, spring semester</i>
The scope of the educational component	<i>4(120)</i>
Semester control/control measures	<i>Test</i>
Class schedule	<i>4 hours per week (2 hours lecture and 2 hours practical classes)</i>
Language of instruction	<i>Ukrainian</i>
Information about the course leader / teachers	Lecturer: Prof., Doctor of Technical Sciences , Valeriy Yuriyovych Shcherbyna, https://cpsm.kpi.ua/shcherbina-valerij-yurijovich.html?tmpl=component ; Prof., Ph.D. , Sivetskyi Volodymyr Ivanovych, https://cpsm.kpi.ua/sivetskij-volodimir-ivanovich.html?tmpl=component; Assoc. Prof., Ph.D. , Sidorov Dmitry Eduardovich, http://intellect.cpsm.kpi.ua/profile/sde9 Practical / Seminar: Prof., Doctor of Technical Sciences , Valeriy Yuriyovych Shcherbyna, https://cpsm.kpi.ua/shcherbina-valerij-yurijovich.html?tmpl=component ; Prof., Ph.D. , Sivetskyi Volodymyr Ivanovych, https://cpsm.kpi.ua/sivetskij-volodimir-ivanovich.html?tmpl=component; Assoc. Prof., Ph.D. , Sidorov Dmitry Eduardovich, http://intellect.cpsm.kpi.ua/profile/sde9
Course placement	<i>Sikorsky Platform</i>

Educational component program

1. Description educational component, goal, subject learning and results teaching

Modernization technological equipment includes a set of measures of improvement designs that provides increase productivity equipment that is being modernized contributes to expansion its technological opportunities to the level modern technical and technological requirements , improvement economic indicators , improvement of working conditions . In general modernization

consists of changes constructions workers mechanisms , machines, installations and other equipment at the expense of using new technical solutions and possible change materials and methods their processing .

Subject of the educational component « Modernization technological equipment » consists in the implementation approaches that provide study newest equipment industries , special methods design for improvement , enhancement efficiency , ensuring high qualities execution of design and construction works development and implementation most effective project decisions . Orients students to modern world level scientific and technical developments in industries application production equipment polymer and construction materials .

The purpose of the educational component " Modernization" technological equipment »

The purpose of the study The educational component is the formation of applicants Bachelor's degree in the systemic complex of knowledge about constructive features , principles works , specifications and areas application equipment that used in production polymer and construction materials and products . Special WARNING provided analysis modern technological decisions , trends modernization equipment , interconnection between construction equipment and quality ready products , as well as methods of increasing its energy efficiency , reliability and environmental friendliness safety .

According to the purpose of preparation bachelors in this field specialty requires strengthening competencies formed in students :

Integral competence :

The ability of a person to solve complex specialized tasks and practical problems in a certain field of professional activity or in the process of learning, which involves the application of certain theories and methods of relevant sciences and is characterized by the complexity and uncertainty of conditions.

GC 1 Ability to think abstractly.

GC 2 Ability to apply knowledge in practical situations.

GC 4 Ability to search, process and analyze information from various sources.

GC 5 Ability to generate new ideas (creativity).

GC 6 Ability to conduct research on at a certain level

FC 1 Ability to apply typical analytical methods and computer software to solve engineering problems in the field of mechanical engineering, effective quantitative methods of mathematics, physics, engineering sciences, as well as appropriate computer software for solving engineering problems industrial mechanical engineering.

FC 2 Ability to apply fundamental scientific facts, concepts, theories, and principles to solve professional tasks and practical problems of the mechanical engineering industry.

FC 5 Ability to use computer-aided design systems and specialized application software to solve engineering problems in the field of mechanical engineering.

FC 7 The ability to make effective decisions regarding the selection of structural materials, equipment, and processes and to combine theory and practice to solve an engineering problem.

FC 11 Ability to analyze, select, and assign processes and equipment for the production of polymeric and building materials and products.

FC 12 Ability to perform engineering calculations on a PC using a high-level algorithmic language (Fortran, etc.)

FC 14 Ability apply rheological laws for calculations parameters technological processes .

Will promote the formation of competencies in students as well using additional provisions , and exactly :

- develop structural and kinematic hydraulic diagrams and drawings of machines and their nodes ;
- to carry out parametric calculations technological equipment , as well as the strength basic details.

According to the requirements educational and professional programs students after assimilation educational component have strengthening demonstrate such results training :

knowledge :

PH 1 Knowledge and understanding of the principles of technological, fundamental and engineering sciences that underlie the branch of mechanical engineering of the relevant industry.

PH 6 Find the necessary scientific and technical information in available sources, in particular, in a foreign language, analyze and evaluate it.

PH 8 Understand appropriate methods and have the skills to design typical assemblies and mechanisms in accordance with the task at hand

RN 1 8 Know and understand the rheological characteristics of media used as raw materials and working media.

RN 1 9 Know and understand the features of the technology of processing polymer materials into products and parts.

skills:

PH 4 Perform engineering calculations to solve complex tasks and practical problems in industrial mechanical engineering.

PH 8 Understand appropriate methods and have the skills to design typical assemblies and mechanisms in accordance with the task.

RN 1 6 Read, analyze, edit source code, write programs for engineering calculations on a PC using a high-level algorithmic language (Fortran, etc.) and appropriate compilers, obtain an object file and an executable file from the source code, and the results of its work.

2. Prerequisites and postrequisites of the discipline (place in the structural and logical scheme of study according to the relevant educational program) program)

The study of the educational component "Modernization of technological equipment" is based on the principles of integrating various knowledge obtained by students during their undergraduate studies while studying natural science and engineering disciplines, in particular: "Equipment of chemical, polymer and silicate production", "Technology of composite materials", "Rheology", "Technology of polymer processing", "Mechanics of a solid deformed body", "Theory of mechanisms and machines", "Theoretical mechanics", "Hydromechanics and hydraulics", "Installation, operation and reliability of technological equipment", "Technological foundations of mechanical engineering", "Occupational safety and civil protection".

3. Content of the educational component

Topic 1. Directions of modernization technological equipment

Topic 2. Design development of innovative proposals

Topic 3. Calculation methods and development options

Topic 4. Technical algorithmic calculations language

Topic 5. Development of applied software software

Topic 6 Design documentation of software software technical calculations

Topic 7 Discoveries , inventions , innovations in design . Structure patents

Topic 8 Levels of structural analysis of machines INTERNET

Topic 9 Requirements for design bachelor's degree works

4 Educational materials and resources

Basic literature

- 1 Shcherbyna V. Yu. *Lecture course "Design Methodology"*. - Kyiv: Publishing House "EKMO", 2010. – 168p.: ill. 19.
- 2 Sivetsky V.I., Shcherbyna V.Yu., Gondlyakh O.V. *Engineering of innovative technologies and equipment. Lines for the production of sheet and profile polymer products [Electronic resource]* / Igor Sikorsky Kyiv Polytechnic Institute. Kyiv, 2022. – 113 p. URL: <https://ela.kpi.ua/handle/123456789/45732>
- 3 V. I. Sivetsky, D. E. Sidorov, O. L. Sokolsky. *Computer modeling and design of polymer equipment*. – K.: Publishing house "EKMO", 2007. – 188p.
- 4 Shcherbyna V.Yu., Sivetsky V.I., Gondlyakh O.V. *Mechanical processes and equipment for the production of polymeric and building materials and products. Preparation of raw materials and equipment for mixing and molding [Electronic resource]* / Igor Sikorsky Kyiv Polytechnic Institute. Kyiv, 2022. – 131p. URL: <https://ela.kpi.ua/handle/123456789/4573> .
- 5 V.Yu. Shcherbyna, S.M. Chernega, Y.M. Samilenko, S.V. Leleka. *Methodological instructions for performing a computer workshop on the COURSE "Design Methodology" Section: "Preparation of working and design documentation"* Electronic manual. 2010. – 70p.: ill.31.
- 6 D. E. Sidorov, I. O. Kazak. *Fundamentals of engineering calculations on a personal computer. Programming in the algorithmic language FORTRAN*. – K: Center for Educational Literature, 2016. – 185 p.
- 7 Kazak I.O., Shcherbyna V.Yu., Leleka S.V., *Methodological recommendations "Modern design methods" (Part 1) [Electronic resource]* / NTUU "KPI", Kyiv, 2017. – 58 p.

Additional literature

8. CAD. *Integrated system for modeling technological processes and calculating equipment for the chemical industry: Textbook*. / O.S.Sakharov, V.Yu.Shcherbina, O.V. Gondlyakh, V.I. Sivetsky. – K.: ООО "Polygraph Consulting", 2006. – 156p.: ill.
9. V.Yu. Shcherbyna, S.M. Chernega, Y.M. Samilenko, S.V. Leleka. *Methodological instructions for performing a computer workshop on the COURSE "Design Methodology" Section: Selection of promising design solutions*. Electronic manual. 2010. – 60p.: ill.21.s
10. Shcherbyna V.Yu., Leleka S.V., Bezverkhyy I.O. *Design methodology. Laboratory practical [Electronic resource]* / Igor Sikorsky Kyiv Polytechnic Institute. Kyiv, 2024. 119 p. URL: <https://ela.kpi.ua/handle/123456789/67997>
- 11 Shcherbyna V.Yu., Shvachko D.G., Gur'eva L.N. *Technology of production of materials and products for construction purposes [Electronic resource]* / Igor Sikorsky Kyiv Polytechnic Institute. Kyiv, 2024. – 188p. URL: <https://ela.kpi.ua/handle/123456789/66516> .
- 12 Nazarenko I.I., Tumanskaya O.V. *Machinery and equipment of building materials enterprises: Designs and basics of operation*. Textbook: K.: Vyscha shkola, 2004. - 590 p.:.
- 13 Dubynin A. I., Atamanyuk V. M., Duleba V. P., Symak D. M.. *Equipment of chemical production and construction materials enterprises*. – Lviv: Publishing House of Lviv Polytechnic, 2013. – 292p.

Information resources on the Internet

- 14 <https://docs.langchain.com> LangChain docs home
- 15 <https://arxiv.org/abs/1910.10683> Exploring the Limits of Transfer Learning with a Unified Text-to-Text Transformer
- 16 <https://arxiv.org/abs/2302.13971> LLaMA: Open and Efficient Baseline Language Models
- 17 <https://mermaid.js.org> Diagramming and charting tool

5. Methodology for mastering the educational component

Lectures are aimed at:

- providing modern, holistic, interdependent knowledge of the educational component, the level of which is determined by the target setting for each specific topic;
- ensuring creative work of students together with the teacher during the lecture;
- fostering professional and business qualities in students and developing their independent creative thinking;
- developing the necessary interest in students and providing direction for independent work;
- determination of the current level of development of science and technology in the field of numerical calculation methods;
- reflection of the methodological processing of the material (highlighting the main ideas and provisions, underlining conclusions, repeating them in different formulations);
- acquisition of visual, combining if possible with the demonstration of audiovisual materials, models, models and samples;
- teaching in clear and concise language, explaining all newly introduced terms and concepts;
- accessibility for audience perception.

No. of the com pan y	Title of the lecture topic and list of main questions (list of didactic aids, references to literature and tasks for the SRS)	Numbe r of hours of CTC
1.	Topic 1. Directions of modernization of technological equipment Energy saving, material consumption, productivity, cost, labor intensity, production waste and recycling, maintainability, disposal. Literature: [3], p. 1 10 - 177; [4], p. 26-45, [8], p. 190-197 , 212-262. Tasks for the SRS. Compare options for the structural design of extrusion and press equipment. Substantiate the feasibility of improving the designs of basic parts and assemblies.	2
2.	Topic 2. Design development of innovative proposals From scheme to design. Requirements for drawings of modernized units and equipment. Requirements for formats. Main inscription. Posters. References: [12], pp. 40-60. [13], pp. 232-293. Tasks for the SRS. Develop sketches of the structural design of the working parts of the machine according to an individual task using patent solutions.	2
3.	Topic 3. Calculation methods and development of options Confirmation of the operability of the modernized equipment by calculations. Selection of methods. Analysis of options. References: [1], pp. 61-110; [2], pp. 64-103; Task on the VTS. Calculate the basic design parameters of the parts of the modernized unit according to the individual task according to the developed design solutions.	2
4.	Topic 4. Technical calculations in algorithmic language Calculations of innovative technical solutions, algorithmic language Fortran in technical calculations. Fortran compilers and programming environments. Methods of compiling source code and features of using compilers from different developers. References: [6] p.12-25 Tasks on the SRS. Algorithmic language Fortran. Fortran compilers and programming environments. Methods of compiling source code and features of using compilers.	2
5.	Topic 5. Application software development	2

	<i>Designing an application for the purpose of the calculation. Planning and defining the project structure. Rules of the algorithmic language. Development of the source code of the software product according to the principles of procedural programming. Graphical representation and analysis of the calculation results.</i> <i>References: [6] pp. 56-68</i> <i>Tasks on the VTS. Development of the software source code. Graphical representation and analysis of the calculation results.</i>	
6.	Topic 6. Preparation of documentation for technical calculation software <i>Compilation of identifier correspondence tables. Rules for compiling flowcharts of algorithms for technical applications. Preparation of technical documentation for technical calculation software. Preparation of results for publication.</i> <i>References: [4], p. 110-118; [5] p. 37-44; [6] p. 156-173</i> <i>Tasks for the CRC. Formatting results and compiling abstracts based on the results of the analysis of calculations.</i>	2
7.	Topic 7. Discoveries, inventions, innovations in design. Structure of patents <i>Discoveries, inventions, innovations in design. Discoveries. Repeated and simultaneous discoveries. Anticipated discoveries. Unexpected (accidental) discoveries. Precursor events. Premature, late discoveries. False discoveries. Invention. Accidental (false) inventions. Repeated and simultaneous inventions. Unexpected inventions. Late inventions. Innovations.</i> <i>International patent classification. Section, class, subclass, group, subgroup in the IPC. Patent structure, descriptive part.</i> <i>References: [1], pp. 17-18, 23-27; [4], pp. 3-40</i> <i>Tasks for the CTS. Defining discoveries, inventions and innovations. Events - predecessors inventions and discoveries. Premature (anticipated) inventions. Late inventions and discovery. Simultaneous and delayed innovations.</i>	2
8.	Topic 8. Levels of structural analysis of machines, INTERNET <i>Search for fundamental design solutions. Methods for searching for solutions on the INTERNET. Search systems. Patent search systems (Ukrpatent, FIPS, EPO). Use of databases, expert and other methods for identifying and analyzing design solutions. INTERNET as a global information resource.</i> <i>References: [4], pp. 5-112; [5], pp. 52-86</i> <i>Tasks on the VTS. The composition of the global network. The concept of "website". The structure of the INTERNET. Ways of obtaining information. Classification of information resources of the INTERNET.</i>	2
9.	Topic 9. Requirements for the design of a bachelor's thesis <i>Bachelor's thesis. Requirements for the structure of a bachelor's thesis. Text documentation for the explanatory note. Graphic part of the work. Binding of the diploma project. Designation of documents according to the department's classifier. Plagiarism check.</i> <i>References: [3], pp. 25-56; [5], pp. 38-46</i> <i>Tasks for VTS. Requirements for text formatting according to ESKD. Classification of text and graphic documentation. Specification formatting.</i>	2
	Total	18

Practical classes

The purpose of the cycle of practical classes in the educational component is to consolidate theoretical knowledge and develop skills in working with modern systems for calculating the strength of chemical production equipment elements and mastering numerical design methods.

Practical work is carried out in a computer classroom using didactic tools and modern software from the Department of Computer Science and Engineering.

The main tasks of the practical training cycle :

- help students to systematize , to consolidate and deepen knowledge theoretical character in the field of modern methods of calculating processes and devices;
- to teach students receptions solving practical problems , contributing to mastery skills and skills performing calculations , graphics and others types of tasks ;
- to teach them to work with scientific and reference literature , documentation and diagrams ;
- to form skills to study independently , that is master methods , ways and techniques self-study , self-development and self-control.

No. of the company	Title of the topic of the practical lesson and list of main questions (list of didactic material, references to literature and tasks for the CTS)	Number of hours of CTC
1.	Topic 1. Directions of modernization of technological equipment Practical lesson 1. Determining directions for modernization of technological equipment (according to the individual task). Literature: [2]; [3] Tasks for the CTS : Identify promising project solutions that meet the goal of the bachelor's thesis.	1
2.	Topic 2. Design development of innovative proposals Practical lesson 2. Development of a schematic and constructive solution (according to the individual task). Literature: [3]; [11] ; [5]; [7] Tasks for the CTS : Development of a schematic and constructive solution in accordance with the topic of the bachelor's thesis.	2
3.	Practical lesson 3. Choosing a methodology for calculating technical innovation and confirming operability. Literature: [2]; [3] Task on the VTS . Based on the selected technical solution, determine the calculation method to confirm the machine's operability.	2
4.	Topic 5. Application software development Practical lesson 4. Project in a programming environment. Planning and defining the project structure. Initial data and object typification . Literature: [3]; [6] Tasks for the VTS : Develop a calculation algorithm and software for entering derived data.	2
5.	Practical lesson 5. Development of applied software. Procedures and program units. Literature: [3]; [6] Task on the CTS . Develop a program algorithm for calculating the structure.	2
6.	Topic 6. Preparation of documentation for technical calculation software Practical lesson 7. Formatting results and preparing abstracts for publication. Literature: [5]; [7] Tasks for the SRS . Based on the results of the research in the bachelor's thesis, prepare an abstract for the conference	1
7.	Topic 8. Levels of structural analysis of machines, INTERNET Practical lesson 8. Studying the possibilities of searching on the INTERNET literary information and fundamental design decisions according to the requirements of the bachelor's thesis. References: [7], pp. 20-32 Tasks on VTS . Identify the possibilities of obtaining information using various search engines	2
8.	Practical lesson 9. Selection of IPC patents for modernization . Search in information retrieval systems and UkrPatent .	1

	References: [7], pp. 43-48 Tasks for VTS : Find patents for modernization in systems and UkrPatent.	
9.	Practical lesson 1 0. Selection of patents for modernization in the European information search system EPO. Preparation of a table of considered patents. Selection of patents for modernization in bachelor's thesis. References: [7], pp. 46-52 Tasks for the CPC : To conduct patents for modernization in the European EPO system.	1
10.	Modular control work	2
11.	Test	2
	Total	18

6. Student's independent work

Independent work of students takes 70% of the time of studying the course, also includes preparation for the test. The main task of independent work of students is to master scientific knowledge in the field of modern methods of calculating machines and apparatuses of chemical production, which are not included in the list of lecture questions, through personal search for information, the formation of active interest in a creative approach in educational work. In the process of independent work within the framework of the educational component, the student must learn to deeply analyze the problem of choosing effective methods of calculating apparatuses of chemical production and, based on calculations, come to their own substantiated conclusions.

No. of the company	Title of the topic to be studied independently	Number of hours of CTC
1.	Topic 1. Directions for modernization of technological equipment. Development of modernization options (according to the individual task). Literature: [1, 2].	6
2.	Topic 2. Design development of innovative proposals Variants of constructive implementation (according to the individual task). Literature: [1, 3].	8
3.	Topic 3. Calculation methods and development of options Analysis of calculation method options (according to the individual task). Literature: [1] , [4].	10
4.	Topic 5. Application software development. Debugging of program code. Literature: [4], pp. 18-158.	10
5.	Topic 6. Preparation of documentation for technical calculation software Presentation of results and preparation of theses based on the results of the analysis of calculations. Literature: [4], pp. 110-118.	6
6.	Topic 7. Discoveries, inventions, innovations in design Definition of discoveries, inventions and innovations. Events - precursors inventions and discoveries. Premature (anticipated) inventions. Late inventions and discovery. Simultaneous and delayed innovations. Literature: [1], pp. 29-45; [8]; [9]	8
7.	Topic 8. Levels of structural analysis of machines, INTERNET Composition of the global network. The concept of "website". Structure of the INTERNET. Ways of obtaining information. Classification of information resources of the INTERNET. Literature: [6], pp. 52-86; [8].	8
8.	Methods of searching for solutions on the INTERNET. Search engines. Patent search systems (Ukrpatent, EPO). Search mechanisms. Agents, crawlers , robots . Web page. Descriptive part, section, class, subclass, group, subgroup.	12

	<i>Literature: [2], pp. 21-43, [8].</i>	
9.	Topic 9. Requirements for the design of a diploma project <i>Requirements for text formatting according to the ESKD. Classification of text and graphic documentation. Formatting of the specification.</i> <i>Literature: [3], c. 11-26; [15], c. 24-36;</i>	6
	<i>Preparation for the modular test</i>	4
	<i>Preparation for the test</i>	6
	Total hours	84

Policy and control

7. Policy of the educational component of the curriculum

Rules for class attendance and behavior in class

Attendance is a mandatory component of assessment. Students are required to actively participate in the learning process, not be late for classes or miss them without a valid reason, not interfere with the teacher conducting classes, and not be distracted by activities unrelated to the learning process.

Rules for assigning incentive and penalty points

- Incentive points can be awarded by the teacher exclusively for performing creative works that correspond to the work program or for additional completion of online specialized courses with the receipt of the corresponding certificate:*
 - <https://intuit.ru/studies/courses/4484/1009/info>*
 - <https://siit.co/courses/fortran-course-and-certification/414/>*
 - <https://www.edx.org/course/a-hands-on-introduction-to-engineering-simulations> ;*

But their sum cannot exceed 25% of the rating scale.

- penalty points within the educational component are not provided.*

Deadline and rescheduling policy

In case of arrears on the educational component or any force majeure circumstances, students must contact the teacher via available (provided by the teacher) communication channels to resolve problematic issues and agree on an algorithm of actions for practice.

Academic Integrity Policy

Plagiarism and other forms of dishonest work are unacceptable. Plagiarism includes the lack of references when using printed and electronic materials, quotes, opinions of other authors. Hints and copying when writing tests, conducting classes are unacceptable; taking credit for another student ; copying materials protected by the copyright system without the permission of the author of the work.

The policy and principles of academic integrity are defined in Section 3 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute". More details: <https://kpi.ua/code>

Academic Conduct and Ethics Policy

Students should be tolerant, respect the opinions of others, formulate objections in a correct form, and provide constructive feedback in class.

The norms of ethical behavior of students and employees are defined in Section 2 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute". More information: <https://kpi.ua/code>

8. Types of control and rating system for assessing learning outcomes (RSO)

Distribution of study time by types of classes and tasks in the educational component according to the working curriculum:

	Study time	Distribution of teaching hours	Control measures
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<i>Semester</i>	<i>Loans</i>	<i>academic year</i>	<i>Lectures</i>	<i>Practical</i>	<i>Lab work</i>	<i>CRC</i>	<i>MKR</i>	<i>Abstract</i>	<i>Terminal CONTROL</i>
8	4	120	18	18	–	84	1	-	test

Student rating for the educational component consists of the points he receives for:

Educational component rating consists of the points he receives for his work in practical classes and for MKR.

Rating (weighting) points system and criteria evaluation

1. Performing practical works.

Weighted score –10. The maximum number of points for all practical work is: 10 points x 9 pr./year = 90 points

Knowledge assessment criteria students

<i>Mark</i>	<i>Completeness answers</i>
10-9	Timely and complete completion of the task, preparation of all programs, conducting settlements, registration and protection without disadvantages
8-7	Minor flaws in the programs that do not affect the results calculations
6-4	Untimely completion of the task, shortcomings in programs, calculations and design
3-0	Failure task

2. Performing a modular control work.

Weighted score – 10 points. Maximum number of points on the modular test work is equal to: 10 points x 1 MCR = 10 points

Penalties and incentives points:

- Incentive points can be awarded by the teacher exclusively for performing creative works that correspond to the work program or for additional completion of online specialized courses with the receipt of the corresponding certificate:
 - <https://intuit.ru/studies/courses/4484/1009/info>
 - <https://siit.co/courses/fortran-course-and-certification/414/>
 - <https://www.edx.org/course/a-hands-on-introduction-to-engineering-simulations> ;

But their sum cannot exceed 25% of the rating scale.

- penalty points within the educational component are not provided.

Thus, the semester rating scale for the educational component is: $RC = R_{pz} + R_{mkr}$
 $= 90 + 10 = 100$ points

According to the results of the academic work for the first 7 weeks, the "ideal student" should score 29 points. At the first certification (8th week), the student receives "passed", if its current rating is at least 14 points.

According to the results of the academic work for 13 weeks of study, the "ideal student" should score 54 points. At the second certification (week 14), the student receives "passed" if his current rating is not less than 29 points.

The maximum score is 100 points. The prerequisite for admission to the test is the completion of all practical courses and a semester rating of at least 34 points. Students who have scored a semester rating of $R_c = 60$ points or more per semester can receive a credit automatically based on the points

earned. Students who have not scored a semester rating of 60 points and have a minimum of 34 points or students who wish to increase their scores in the educational component write a credit written exam work.

On For the test, students complete written work. Each task contains 2 questions. Each question is worth 50 points. Grading system questions:

- "excellent", complete answer (at least 90% of the required information) – 50-49 points;
- "good", sufficiently complete answer (at least 75% of the required information or minor inaccuracies) – 48-35 points;
- "satisfactory", incomplete answer (at least 60% of the required information and some errors) – 34-11 points;
- "unsatisfactory", unsatisfactory answer – 10-0 points.

The sum of the starting points and points for the credit work is converted into the credit score according to table.

Number of points	Rating
95 ... 100	perfectly
85 ... 94	very good
75 ... 84	good
65 ... 74	satisfactorily
60 ... 64	enough
RD < 60	unsatisfactorily
Admission conditions not met	not allowed

9. Additional information on the educational component

<https://cpsm.kpi.ua/>

Approximate list of issues submitted to the MCR

1. Describe the possibilities and directions for modernizing the extruder worm
2. Describe the possibilities of upgrading the support station in a rotating thermal unit
3. Justify the modernization of the worm extruder housing
4. Explain the meaning and differences in the concepts of discovery, invention, and innovation.
5. Explain the meaning and content of the terms "anticipated discoveries" and "unexpected (accidental) discoveries."
6. Explain the meaning and content of the terms "late discoveries" and "false discoveries."
7. Simultaneous and delayed innovations are the link between creation and use.
8. INTERNET search mechanisms, thematic search
9. What is the International Patent Classification IPC?
10. Section, class, subclass, group, subgroup in the IPC.
11. How to determine the patent code according to the IPC?
12. What does the patent subgroup index consist of?
13. Explain the sequence of selecting a patent in the UkrPatent search system.
14. Explain the sequence of selecting a patent in the European EPO search system.
15. How is object typing performed in Fortran programs?
16. What is a project and what is included in the MSDev project?
17. What are software units? How to plan and define the composition of a project?
18. List the rules for working with data and how to change the default rule in Fortran.
19. How is documentation for technical applications prepared?
20. What programming units are used in Fortran calculations?
21. List ways to organize cyclical calculations and provide examples.
22. How to get an executable file if the source code is contained in multiple files?

23. Give examples of compiler console commands and explain what happens when they are executed.
24. How to organize a file interface for data input and output?
25. List ways to organize branching calculations and provide examples.
26. What methods of organizing the interface between program units can be used in Fortran?

Approximate list of questions submitted for semester control

1. Describe the possibilities and directions for modernizing the extruder worm
2. Justify the modernization of the worm extruder housing
3. Explain the main differences between the concepts of "discovery", "invention" and "innovation".
4. Explain the meaning and content of the terms "anticipated discoveries" and "unexpected (accidental) discoveries."
5. Explain the meaning and content of the terms "late discoveries" and "false discoveries."
6. Simultaneous and delayed innovations are the link between creation and use.
7. Indicate the mechanisms for searching for information on the INTERNET that are most effective for thematic research.
8. Explain what the International Patent Classification (IPC) is and what it is used for.
9. Describe the elements that make up the structure of a section, class, and subclass in the IPC.
10. Indicate how to determine the patent code using the IPC.
11. Describe the components that make up the patent subgroup index.
12. Explain the sequence of selecting a patent in the UkrPatent search system.
13. Explain the sequence of selecting a patent in the European EPO search system.
14. Explain how object typing is implemented in Fortran programs.
15. Explain the concept of a project and what elements make up a project in the MSDev environment.
16. Describe the definition of program units, as well as how a project can be planned and defined.
17. List the rules for working with data and how to change the default rule in Fortran.
18. How is documentation for technical applications prepared?
19. What programming units are used in Fortran calculations?
20. List ways to organize cyclical calculations and provide examples.
21. How to get an executable file if the source code is contained in multiple files?
22. Give examples of compiler console commands and explain what happens when they are executed.
23. How to organize a file interface for data input and output?
24. List ways to organize branching calculations and provide examples.
25. Specify the methods of organizing the interface between program units available in Fortran.
26. Describe the possibilities of upgrading the cooling system of a rotary kiln.
27. To justify the need to modernize the extruder drive mechanism.
28. Explain the role of patent analysis in the development phase of technical innovations.
29. Give examples of using open patent databases to search for analogues.
30. Indicate the main criteria for patentability of an invention.
31. Explain the concept of "innovation cycle" and its stages.
32. Describe ways to type variables in Fortran programs.
33. Explain the purpose of modules in Fortran and their role in structuring a project.
34. Give examples of subroutine organization (SUBROUTINE and FUNCTION) in Fortran.
35. Indicate methods for error control when executing Fortran programs.
36. Describe the possibilities of upgrading the material feed system into the extruder.
37. To justify the feasibility of using composite materials in the design of a rotary kiln.
38. Explain the difference between an invention, a utility model, and an industrial design.
39. Give examples of famous innovations that arose as a result of accidental discoveries.
40. Indicate the sources of information used when conducting a patent search.
41. Explain the meaning of the patent wording (claims) in the document.
42. Describe the procedure for creating and using arrays in Fortran programs.
43. Explain the purpose of the `IMPLICIT NONE` and `SAVE` operators in Fortran.
44. List the methods for passing parameters to subroutines and functions in Fortran.

45. *Indicate the main stages of compiling and building a project in the MSDev environment.*

Work program of the educational component (syllabus):

Compiled by Prof., Doctor of Engineering Sciences, Shcherbina V.Yu.

Approved by the department HPSM (protocol no. 17 from 04.06.2025)

Approved by the Methodological Commission of the Faculty of Chemical Engineering (Minutes No. 11 from 27.06.2025)