



Educational component 5 of the F-Catalog. Methodology designing

Work program of the educational component (Syllabus)

Educational component details

Level of higher education	<i>Second (Master's)</i>
Discipline	<i>G - Engineering, Manufacturing and Construction</i>
Specialty	<i>G9 Applied Mechanics</i>
Educational program	<i>OPP Packaging and Packaging Equipment Engineering</i>
Status of the educational component	<i>Selective</i>
Form of study	<i>full-time (day)</i>
Year of training, semester	<i>1st year, spring semester</i>
The scope of the educational component	<i>4(120)</i>
Semester control/control measures	<i>Test</i>
Class schedule	<i>2 hours per week (1 hour of lectures, 1 hour of practical)</i>
Language of instruction	<i>Ukrainian</i>
Information about the course leader /teachers	Lecturer: Prof., Doctor of Technical Sciences, Valeriy Yuriyovych Shcherbina, https://cpsm.kpi.ua/shcherbina-valerij-yurijovich.html?tmpl=component; Practical / Seminar: Prof., Doctor of Engineering, Valeriy Yuriyovych Shcherbina, https://cpsm.kpi.ua/shcherbina-valerij-yurijovich.html?tmpl=component;
Course placement	<i>Sikorsky Platform</i>

Educational component program

1. Description of the educational component, its purpose, subject of study and learning outcomes

One of the most pressing problems of modern mechanical engineering is the reduction of the design period of technological equipment and the improvement of the technical and economic characteristics of the equipment being designed. In the course "Design Methodology", considerable attention is paid to the identification and use of the relationship between individual special educational components. This is possible with the systematic application of certain branches of knowledge, which include specific research methods and solving problems of the design process itself, its improvement and increase in efficiency. This includes such sections as technological design, morphological models, a systems approach, and others, which are of significant interest to a modern specialist. The purpose of the presentation of the material is to study methods for technological forecasting of parameters of machines being designed, taking into account the requirements for the operation and manufacture of machines, assemblies and parts, familiarization with the basics of CAD and means of planning scientific and research work at the stages of determining the purpose of the project and its finalization.

The subject of the educational component "Methodology" "Design" - implementation of approaches that provide the study of the latest design systems and special methods for improving, increasing efficiency, ensuring high quality of design and development with the implementation of the most effective design solutions. The educational component orients students to the modern world level of scientific and technical developments.

Purpose of the educational component « Methodology design »

The purpose of studying this educational component is to study the information support used in design for possible technological prediction of machine parameters, designed taking into account the requirements for the operation and manufacture of machines, assemblies and parts, to familiarize with the basics of computer-aided design systems and means of planning research and development work at the stages of determining the purpose of the project, its implementation and refinement.

In accordance with the goal, the training of masters in this specialty requires strengthening the competencies formed in students:

Integral competence:

The ability to solve complex tasks and problems in applied mechanics or in the learning process, which involves conducting research and/or implementing innovations and is characterized by uncertainty of conditions and requirements.

Ability to identify, pose and solve engineering, technical and scientific-applied problems ZK01

Ability to use information and communication technologies ZK02.

Ability to generate new ideas (creativity) ZK03.

Ability to develop and manage projects ZK04.

Ability to learn and master modern knowledge ZK06.

The ability to apply appropriate methods and resources of modern engineering to find optimal solutions to a wide range of engineering problems using modern approaches, forecasting methods, information technologies and taking into account existing limitations under conditions of incomplete information and conflicting requirements FC01.

The ability to describe, classify, and model a wide range of technical objects and processes, based on a deep knowledge and understanding of the theories and practices of mechanical engineering, as well as knowledge of related sciences FC02.

Ability to engineer packaging equipment to ensure performance under operational loads and environmental influences FC05

Ability to search and analyze scientific and technical information regarding engineering of technological equipment FC06

Ability to master new types of equipment and technology in the packaging industry and related industries FC09

Ability to carry out design activities in the field of packaging equipment FC10

The use of additional provisions will also contribute to the formation of students' competencies, namely:

- ability to search and analyze scientific and technical information;*
- the ability to present the results of independent design and scientific work with their justification and publication.*

According to the requirements of the educational and professional program, after mastering the academic discipline, students should strengthen their ability to demonstrate the following learning outcomes:

knowledge:

Apply specialized conceptual knowledge of the latest methods and techniques for designing, analyzing, and researching structures, machines, and/or processes in the field of mechanical engineering and related fields of knowledge PRN 01

Search for the necessary information in scientific and technical literature, electronic databases and other sources, assimilate, evaluate and analyze this information PRN10

Choose the type and rational design of packaging equipment and its components based on an analysis of the features of the packaging technological process and the packaged product PRN18

Knowledge of the principles and methods of designing basic packaging and auxiliary equipment PRN23

skills :

Develop and put into production new types of products, in particular, perform research and development work and/or develop technological support for the process of their manufacture PRN02

Apply automation systems to perform research, design work, technological preparation and engineering analysis in mechanical engineering PRN03

Use modern methods of optimizing the parameters of technical systems using systems analysis, mathematical and computer modeling, in particular under conditions of incomplete and contradictory information PRN04

Independently set and solve innovative problems, argue and defend the results obtained and decisions made PRN05

Master modern knowledge, technologies, tools and methods, in particular through independent study of professional literature, participation in scientific and technical and educational events PRN08

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

*Study of the educational component « **Methodology design** » is based on the principles of integrating various knowledge obtained by students during the bachelor's degree while studying educational components of the natural and engineering directions, in particular: "Mathematics", "Engineering and computer graphics", "Informatics", "Resistance of materials", "Machine parts", "Hydraulics and drives of mechatronic systems", "Theoretical foundations of heat engineering", "Mechanics of a deformed solid", "Technological foundations of mechanical engineering", "Modern methods of calculating processes and devices", "Processes, devices and machines of the industry".*

3. Content of the educational component

Topic 1 Design stages in the development of new machines and modernization of existing equipment

Topic 2 Ways to improve the mechanical equipment design process

Topic 3 System and structural analysis of machines

Topic 4 Searching for promising design solutions

Topic 5 Research and Development Planning

Topic 6 Preparation of project documentation and publication

Topic 7 Using artificial intelligence technology in design

4. Educational materials and resources

Basic literature

1Shcherbyna V.Yu., Leleka S.V., Bezverkhy 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>

2Shcherbyna V. Yu. Lecture course "Design methodology". - Kyiv: Publishing house "EKMO", 2010. – 168p.: ill. 19.

- 3Kazak I.O., Shcherbyna V.Yu., Leleka S.V. , Methodological recommendations "Modern design methods" (Part 1) [Electronic resource] / NTUU "KPI", Kyiv, 2017. – 58 p.
- 4V.Yu. , Design methodology. Lecture notes [Electronic resource] / Igor Sikorsky Kyiv Polytechnic Institute. Kyiv, 2020. – 77 p. URL : [http://ela.kpi. u a/handle/123456789/25673](http://ela.kpi.ua/handle/123456789/25673)
- 5Shcherbyna V.Yu., Chernega S.M., Samilenko Y.M., Leleka S.V. Methodological instructions for performing a computer workshop on the COURSE "Design Methodology" Section: "Design of working and design documentation" Electronic manual. 2010. – 70p.: ill.31.
- 6V.Yu. , Ivitsky I.I., Leleka S.V. , Design methodology. Laboratory practical on the academic discipline [Electronic resource] / Igor Sikorsky Kyiv Polytechnic Institute. Kyiv, 2018 . – 67 p. URL : [http://ela.kpi .ua /handle/123456789/25671](http://ela.kpi.ua/handle/123456789/25671)
- 7Kazak I.O., Shcherbyna V.Yu., Leleka S.V. , Methodological recommendations "Modern design methods" (Part 2) [Electronic resource] / NTUU "KPI", Kyiv, 2017. – 60 p.

Additional literature

8. 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>
9. CAD. Application of the VESNA software complex in calculations of processes and equipment taking into account thermal power loads. / V.Yu. Shcherbyna, O.S. Sakharov, V.I. Sivetsky, O.V. Gondlyakh Textbook Kyiv, Publishing House “EKMO”, 2014. – 218 p.
- 10Policy on the use of artificial intelligence for academic activities at Igor Sikorsky Kyiv Polytechnic Institute. <https://ela.kpi.ua/server/api/core/bitstreams/70b895b5-1339-4d51-975b-a6114035c950/content>
- 11Shcherbyna 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> .
- 12Intensification of extraction in the technology of vegetable oil production./ Vlasenko V.V., Bandura V.M., Kolyanovska L.M. / Vinnytsia, RVV VNAU, 2016. – 203 p .
- 13Shcherbyna 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> .
- 14Shcherbyna V.Yu., Stepanyuk A.R. Shell-and-tube heat exchangers. Design design of equipment [Electronic resource] / Igor Sikorsky Kyiv Polytechnic Institute. Kyiv, 2024. 117 p. URL: <https://ela.kpi.ua/handle/123456789/67996> .
15. 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.: OOO “Polygraph Consulting”, 2006. – 156p.: ill.

Information resources on the Internet

16. <https://docs.langchain.com> LangChain docs home
- 17<https://arxiv.org/abs/1910.10683> Exploring the Limits of Transfer Learning with a Unified Text-to-Text Transformer
- 18<https://arxiv.org/abs/2302.13971> LLaMA: Open and Efficient Baseline Language Models
- 19<https://mermaid.js.org> Diagramming and charting tool
- 20<https://arxiv.org/abs/2005.11401> Retrieval-Augmented Generation for Knowledge-Intensive NLP Tasks

5. Methodology for mastering the educational component

Lectures are aimed at:

- providing modern, holistic, interdependent knowledge on the subject, 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 company	Title of the lecture topic and list of main questions (list of didactic aids, references to literature and tasks for the SRS)	Number of listening hours
1.	Topic 1. Design stages in the development of new machines and modernization of existing equipment. Introduction. General provisions. Development of new equipment. Project and design. Stages of project work. Project characteristics. Automated design systems and product life cycle. References: [2], pp. 3-6; [3], pp. 3-15; [9], pp. 3-18. Tasks for the VTS. Requirements for new equipment. The concept of project and design. Stages of project work. Stages of the product life cycle. Properties and characteristics of the product are functional; constructive; technological; economic; operational; ergonomic; aesthetic.	1
2.	Machine design process. Project quality. Technical proposal. Preliminary design. Technical design. Detailed design.—Main reasons for equipment unreliability. Two types of designed equipment. Development of technical specifications. Stages of design (innovation) References: [2], pp. 5-17; [4], pp. 44-47. Tasks for the VTS. Stages of project work. Project characteristics. Design stages, research and development work. Working project. Experimental samples. Program of research and development work.	1
3.	Topic 2. Ways to improve the design process of mechanical equipment Risk of obsolescence and technical failure in design. Solution of compromise problems. Replacement or improvement of equipment. Construction of a schedule for carrying out optimal design work. Economic justification of the project. Ways to accelerate the design process. Passive experiment in the study of design processes. Coefficient of overspending on project implementation. Novelty parameter. References: [3], pp. 8-43; [9], pp. 19-22; [14], pp. 36-52. Tasks on the VTS. The relationship between the risk of obsolescence and technical failure. Cost accumulation, U-shaped cost form. Project goal planning. Passive and active experiment in the study of design processes. Coefficient of variation of project costs.	2
4.	Topic 3. System and structural analysis of machines	2

	Systems analysis of machines. Search forecasting. Normative forecasting methods for establishing the project goal. System-hierarchical approach. System approach to project implementation. Concepts of system, subsystem, elements. System as a subsystem of a higher or lower level. References: [4], pp. 11-18, 26-115; Tasks on the VTS. Search and normative forecasting. Block-hierarchical design structure. System approach to project implementation. Top-down, bottom-up and mixed design. Iterative nature of design.	
5.	Topic 4. Search for promising design solutions Search engines. Search methods. Catalogs for searching by topics. Search index for searching by keywords Popular search engines. Patent search. Using databases, expert and other methods to identify and analyze design solutions. INTERNET as a global information resource. References: [4], pp. 92-128, [15], pp. 5-12; [12], pp. 5-112. Tasks on the VTS. Methods of searching for solutions on the INTERNET. Search engines. Patent search systems (Ukrpatent, EPO). Search mechanisms. Agents, crawlers , robots . International patent classification. Patent structure: descriptive part, section, class, subclass, group, subgroup. Agents, crawlers, robots. Descriptive part, section, class, subclass, group, subgroup.	2
6.	Topic 5. Research and development planning Literature sources. Literature review in scientific research. Tasks of a literature review. Search for primary sources. Study of theory. Experimental methodology. Reporting documents and publications on conducted research. Publication of work results. Scientific article, abstracts of conference reports. Requirements for scientific publications. Presentation of material. Description of methodology. References: [11], pp. 8-14, 23 - 58; [15], pp. 19-22; [11], pp. 92-117 ; [5], pp. 57-61; [6], pp. 36-40 Tasks on the SRS. Organization of measurements. Intermediate assumptions and restrictions, the domain of existence of the solution and the method of comparison with the experiment. The first and second stages in experimental studies. Measurement errors. Reference and working measurements. Structure of the article, description of illustrations, methods of conducting experimental research.	2
7.	Topic 6. Preparation of project documentation and publication Development stages. General requirements for graphic, design and text documentation. Requirements for design in WORD. Naming and numbering of sections, subsections and paragraphs. Formulas in the text, numbering and references. Design of illustrations and appendices. Design of tables and references. References: [9], pp. 24-36, [3], pp. 11-18, 26-115 Tasks on the VTS. Formatting the table of contents and references. Inserting, updating the table of contents. Subject index. Automatic marking of index elements. Setting cross-references. Numbering formulas. References. Inserting numbers into the caption under the figure. Organizing calculations. Creating graphs. Requirements for text formatting according to the ESKD.	2
8.	Topic 7. Using artificial intelligence technology in design General information on the use of artificial intelligence (AI) technologies. Examples of AI applications in mechanical engineering. AI algorithms. Search for technical solutions. References: [1], pp. 62 - 72 , [10], pp. 3-10 Tasks for the SRS. The concept of AI and its main types. History of development. AI algorithm for finding technical solutions.	2

9.	Neural network aggregators. Using Deep modes in chatbots Search and Think for deep analysis, logical reasoning and data visualization. Editing text information using the CANVAS model . References: [16] ; [18]; [20] Tasks on the SRS. The main functions of neural network aggregators. Differences between deep analysis and logical reasoning modes. Combining Deep Search and Think modes to solve complex analytical tasks. Methods of data visualization in a neural network. Text editing capabilities using the CANVAS model.	2
	Total hours	16

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 lesson topic and list of main questions (list of didactic resources, references to literature and tasks for the CTS)	Number of listening hours
1.	Topic 1. Design stages in the development of new machines and modernization of existing equipment Practical exercise 1. Investigate the level of basic functional characteristics of rotary cement kilns by 2030 (or equipment on the topic of the master's thesis). Literature: [9], c. 19-22; [3] c. 8-43; Tasks for the CTC : Conduct a study of the level of basic functional characteristics of rotary cement kilns by 2030 (or equipment on the topic of the master's thesis).	2
2.	Topic 3. System and structural analysis of machines Practical lesson 3*. Investigate, by performing search forecasting, the prospects for the development of the technology used in the master's thesis. Literature: [9], pp. 24-36 Tasks for the CTS . Conduct research into the prospects for the development of technology used in the master's thesis	2
3.	Topic 4. Search for promising design solutions Practical lesson 4. Selection of patents for modernization in the information and search system UkrPatent and EPO Literature: [9], pp. 19-23; [18]; [14] Tasks for the CPC : Find patents for modernization in the UkrPatent and EPO systems.	2
4.	Topic 7. Using artificial intelligence technology in design Practical lesson 6. Assessing the relevance and determining the research methodology in a master's thesis.	2

	<i>References: [1], pp. 76-78, 101-106</i> Tasks on the CTC . Using the chatbots ChatGPT, Copilot, Gemini and Poe, determine the relevance and directions of a possible scientific research in the master's thesis. Analyze the results obtained and provide a conclusion in which to indicate which of the chatbots were the most effective, offering complete and meaningful answers. Also indicate which answers had shortcomings and what they consist of.	
5.	<i>Practical lesson 7*. Analysis and description of graphs and illustrations using AI.</i> <i>References: [1], pp. 82-89 , 112-116</i> Tasks on the CTS . Using the Copilot, ChatGPT, Gemini and Poe chatbots, analyze and describe graphs and illustrations. Analyze the responses received by the AI and draw a conclusion, indicating which of the chatbots were the most effective, providing complete and meaningful responses; which responses had shortcomings, what they consist of.	2
6.	<i>Modular test work.</i>	2
7.	<i>Test</i>	2
	Total hours	14

- - additional or elective work.

6. Laboratory classes (computer lab)

According to the working curriculum, laboratory classes are not provided.

7. Student's independent work

Independent work of students takes 75% 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 and in the performance of coursework. 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. Design stages in the development of new machines and modernization of existing equipment Requirements for new equipment. Concept of project and design. Stages of project work. Stages of the product life cycle. Properties and characteristics of the product: functional; constructive; technological; economic; operational; ergonomic; aesthetic. Literature: [2], c. 3-6; [9], c. 3-18; [3], c. 3-15.	4
2.	Subsystems for users to master technologies implemented in CAD. Technical (TO), mathematical (MO), software (PO), information (IS), linguistic (LO), methodological, organizational (GO) support. Literature: [2] p. 11-15; [4]] p. 41-43	4

3.	<i>Design information support systems. Systems for strength calculation – ANSYS, ADAMS, Pro/ENGINEER, CATIA, LS-DYNA. Systems for solving aerohydrodynamics problems – Star-CD, CFX, FLUENT, FlowVision, FLOW-3D. Design systems – AutoCAD, KOMPAS, Genius, CADMECH, Autodesk Inventor, T-FLEX CAD. Combined systems – SolidWorks, SolidEdge, Unigraphics, CADDy..</i> <i>Literature: [5], c. 8-42; [15], c. 28-45.</i>	7
4.	<i>Calculation and engineering analysis and design systems. Enterprise management systems (ASUP) and technological processes (ACSTP).</i> <i>Literature: [2], c. 112-128; [9], c. 54-68.</i>	2
5.	<i>Stages of project implementation. Project characteristics. Design stages, research and development work. Working project. Experimental samples. Research and development program.</i> <i>Literature: [2], c. 5-17; [2], c. 44-47.</i>	4
6.	<i>Definition of discoveries, inventions and innovations. Events - precursors inventions and discoveries. Premature (anticipated) inventions. Late inventions and discovery. Simultaneous and delayed innovations.</i> <i>Literature: [9], c. 17-18, 23-27; [12], c. 3-40;</i>	4
7.	<i>Definition and purpose of experimental research. Stages of innovation.</i> <i>Literature: [2], c. 7-18; [2], c. 12-16;</i>	2
8.	Topic 2. Ways to improve the design process of mechanical equipment <i>The relationship between obsolescence risk and technical failure. Cost accumulation, U-shaped cost form. Project goal planning. Passive and active experimentation in the study of design processes. Coefficient of variation of project costs.</i> <i>Literature: [4], c. 19-22; [3], c. 8-43; [14], c. 36-52</i>	4
9.	Topic 3. System and structural analysis of machines <i>Search and normative forecasting. Block-hierarchical design structure. System approach to project implementation. Top-down, bottom-up and mixed design. Iterative nature of design.</i> <i>Literature: [4], c. 24-36, [3], c. 11-18, 26-115</i>	4
10.	<i>Examples of centralized and decentralized systems. The role of the system in choosing a modernization topic. Internal and external connections and their interaction between parts of the system.</i> <i>Literature: [3], c. 40-72; [12], c. 12-18</i>	2
11.	<i>Types of structures. A structure in which the input of subsystems is the output of the previous subsystem. A structure in which the output of the previous system is the input of several subsystems.</i> <i>Literature: [3], pp. 16-32, 70-86</i>	4
12.	Topic 4. Search for promising design solutions <i>Methods of searching for solutions on the INTERNET. Search engines. Patent search systems (Ukrpatent, EPO). Search mechanisms. Agents, crawlers , robots . International patent classification. Patent structure: descriptive part, section, class, subclass, group, subgroup. Agents, crawlers, robots. Descriptive part, section, class, subclass, group, subgroup.</i> <i>Literature: [4], c. 92-128, [8], pp. 5-28.</i>	8
13.	Topic 5. Research and development planning	4

	<i>Organization of measurements. Intermediate assumptions and restrictions, the domain of existence of the solution and the method of comparison with the experiment. The first and second stages in experimental research.</i> <i>Literature: [11], pp. 8-14, pp. 23-58.</i>	
14.	<i>Structure of the article, description of illustrations, methods of conducting experimental research.</i> <i>Literature: [13].</i>	4
15.	Topic 6. Designing a project documentation <i>Designing the table of contents and references. Inserting and updating the table of contents. Subject index. Automatic marking of index elements. Establishing cross-references. Numbering formulas. References. Inserting numbers in the caption under the figure. Organizing calculations. Building graphs.</i> <i>Literature: [8], pp. 48-56</i>	6
16.	Topic 7. Using artificial intelligence technology in design <i>The concept of AI and its main types. History of development. AI algorithm for finding technical solutions. Ethical and legal aspects of using AI.</i> <i>References: [1], pp. 62 - 72 , [10], pp. 3-10</i>	7
17.	<i>The main functions of neural network aggregators. Differences between deep analysis and logical reasoning modes. Combining Deep Search and Think modes to solve complex analytical tasks. Methods of data visualization in a neural network. Text editing capabilities using a model</i> <i>References: [16]; [18]; [20]</i>	10
18.	<i>Preparation for the ICR</i>	4
19.	<i>Preparation for the test</i>	6
	Total hours	90

Policy and control

8. Educational component policy

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 work within the framework of the work program or for additional completion of online specialized courses with the receipt of the corresponding certificate:*
 - <https://www.edx.org/micromasters/purdue-reliability-and-decision-making-in-engineering-design> ;*
 - <https://www.edx.org/course/a-hands-on-introduction-to-engineering-simulations> ;*
 - <https://www.edx.org/micromasters/mitx-principles-manufacturing> .*

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>

9. 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:

Semester	Study time		Distribution of teaching hours				Control measures		
	Loans	academic year	Lectures	Practical	Lab work	CRC	MKR	RR	Semester control
2	4	120	16	14	–	90	1	–	hall and kitchen

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

- 1) performance and defense of practical work;
- 2) one modular test.

Rating (weighting) points system and evaluation criteria

1. Practical work

Weighted score –13.0 . The maximum number of points for all practical work is:

13.0 points x 7 points/year = 90 points

Criteria for assessing student knowledge

Mark	Completeness of the answer
11-13	Timely and complete completion of the task, preparation of all programs, calculations, registration and protection without flaws
7-10	Minor flaws in the programs that do not affect the calculation results
3-7	Untimely completion of the task, shortcomings in programs, calculations and design
0	Failure to complete the task

2. Modular test work

In order to control knowledge and skills, a modular test is conducted at the penultimate lecture, which is evaluated at 5 points.

Weighted score Rcr =5 points

Evaluation criteria:

A score of 5 is given if the problem is solved without errors;
 A score of 4 is awarded if the problem is solved with a minor error;
 a score of 3 is given if the problem is solved with several errors;
 A score of 0-2 is assigned if the problem is solved with a significant error or is absent.

Penalty and incentive points for:

- Incentive points can be awarded by the teacher exclusively for performing creative work within the framework of the work program or additional completion of online specialized courses with obtaining the corresponding certificate from (+2...+5) points:
 - <https://www.edx.org/micromasters/purdue-reliability-and-decision-making-in-engineering-design> ;
 - <https://www.edx.org/course/a-hands-on-introduction-to-engineering-simulations> ;
 - <https://www.edx.org/micromasters/mitx-principles-manufacturing> .
 - penalty points within the educational component are not provided.
- Calculation of the rating scale (R):
 The sum of the weighted points of control measures during the semester is:
 $R_c = R_{pz} + R_{kr} = 90 + 5 + (+2...+5) = 100$ points.

The credit component of the scale is equal to
 $R_z = 100$ points.

According to the results of the academic work in the first 7 weeks, the "ideal student" should score 30 points. At the first certification (8th week), the student receives "passed" if his current rating is at least 15 points.

Based on the results of 13 weeks of study, the "ideal student" should score 60 points. At the second certification (week 14), the student receives a "pass" if his current rating is at least 30 points.

The maximum sum of points from all control measures for the credit (practical work, modular control work) is 100 points. A prerequisite for admission to the credit is the submission of a report on practical work. Students who have a rating of less than 30 points at the end of the semester are not allowed to take the credit.

Students who have scored $R_c = 60$ points or more per semester can receive a credit automatically based on the points they have scored. Students who have not scored a semester rating of 60 points and have at least 30 points or students who wish to increase their scores in the educational component complete a credit written work. The credit ticket contains 2 questions. The weighted score of each question is 50 points. Question evaluation system:

- "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) – 48-40 points;
- "satisfactory", incomplete answer (at least 60% of the required information and some errors) – 39-11 points;
- "unsatisfactory", unsatisfactory answer – 10-0 points.

Thus, the rating scale for the discipline is $R = R_z = 50 + 50 = 100$ points.

The condition for admission to the test is a minimum rating of R_c , 30 points ($R_c = 30$ points).

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

10. Additional information on the educational component

Approximate list of questions that are asked on the MCR and the test

1. Explain the stages of the life cycle of a designed product
2. Explain the conceptualization stage in the life cycle of a design object.
3. What is done during functional, design and technological design.
4. Explain the concept of a project. The main types of research and development project work.
5. Explain the concept of a project. The main types of design work in the field of civil engineering.
6. Describe the stages of project development.
7. What is done at the project stages – Technical Terms of Reference and Technical Proposal.
8. What is done at the project stages – Preliminary design and Technical design.
9. Describe the design stages.
10. Explain the meaning and differences in the concepts of discovery, invention, and innovation.
11. Innovation, the connection between the term creation and use.
12. Describe the methodology for building a schedule for optimal project work.
13. Explain the meaning of the terms risk of obsolescence and technical failure in design.
14. Formulate and explain the significance of passive experimentation in the design process by determining the cost overrun coefficient.
15. Explain the essence of search forecasting.
16. Explain the essence of normative forecasting.
17. Explain the essence of the systemic - hierarchical approach to project implementation
18. Formulate and explain the concept of top-down design in system-hierarchical analysis
19. Formulate and explain the concept of bottom-up design in systems-hierarchical analysis
20. Describe a systems approach to machine design.
21. Describe the conditions for distinguishing an object as a system.
22. Describe the relationships in the system during systems analysis.
23. Explain the essence of centralized and decentralized systems.
24. Formulate and explain the importance of the role of the system when choosing a modernization topic.
25. Describe the basic principles for building a structural system.
26. Describe the types of structures in the system.
27. Formulate general requirements for admission and highlight the relevance of the work.
28. What do the terms object and subject of research mean?
29. Literature review and methodology for searching for literary sources
30. Describe the use and presentation of graphs in a report.
31. Formulate and explain the meaning of measurement errors and their impact on the results obtained.
32. Describe the article's structure, organization, and description of calculations.
33. Formulate general requirements for the structure of a text document and the design of illustrations.
34. Formulate general requirements for text documentation.
35. Formulate general requirements for the Literature Review section.

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)