



Mechanical processes and equipment for the production of polymer

and Building Materials and Products

Work program of the educational component (Syllabus)

Details of the educational component

Higher education level	<i>First (bachelor's)</i>
Field of Knowledge	<i>13 Mechanical Engineering</i>
Specialty	<i>133 Industrial mechanical engineering</i>
Educational program	<i>OPP Engineering of equipment for the production of polymer and building materials and products Engineering of equipment for the production of polymeric and building materials and products</i>
Status of the educational component	<i>normative</i>
Form of study	<i>full-time</i>
Year of preparation, semester	<i>4th year, autumn semester</i>
Scope of the educational component	<i>5 (150)</i>
Semester control / control measures	<i>Exam</i>
Class schedule	
Language of instruction	<i>Ukrainian</i>
Information about the course leader / teachers	<i>Lecturer: Doctor of Technical Sciences, Senior Researcher, Prof. Mikulionok Ihor Olehovich, i.mikulionok@kpi.ua, 066-748-65-65 Practical: Doctor of Technical Sciences, Senior Researcher, Prof. Mikulionok Ihor Olehovich Laboratory: Doctor of Philosophy Vytvytskyi Viktor Myronovych</i>
Course placement	<i>http://login.kpi.ua/.</i>

Program of the educational component

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

The educational component "Mechanical Processes and Equipment for the Production of Polymer and Building Materials and Products" is one of the basic educational components of the cycle of educational components of professional training, which lays the foundations for the training of specialists in industrial engineering (chemical, polymer and silicate engineering) and has a theoretical and practical direction.

The subject of the educational component "Mechanical Processes and Equipment for the Production of Polymer and Building Materials and Products" is the theory of basic mechanical processes, the principles of construction and methods of calculation of machines and devices used to carry out these processes.

The purpose of the educational component "Mechanical processes and equipment for the production of polymer and building materials and products"

The purpose of the educational component is the process of forming a complex of knowledge by students about the main mechanical processes, making a reasonable choice of equipment for the implementation of mechanical processes and performing their parametric calculations.

In accordance with the goal, the training of bachelors in this specialty requires strengthening the formation of the following competencies:

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 training, which involves the application of certain theories and methods of the relevant sciences and is characterized by complexity and uncertainty of conditions.*

Professional competencies:

- *ability to make effective decisions on the choice of structural materials, equipment, processes and combine theory and practice to solve an engineering problem (FC7);*
- *ability to analyze, select, assign processes and equipment for the production of polymer and building materials and products (FC11);*
- *the ability to describe and classify a wide range of technical objects and processes, based on deep knowledge and understanding, knowledge of related technical sciences (FC13).*

*According to the requirements of the program of the educational component "Mechanical Processes and Equipment for the Production of Polymer and Building Materials and Products", students after mastering it must demonstrate the following **program learning outcomes**:*

- *knowledge and understanding of the principles of technological, fundamental and engineering sciences that underlie the branch engineering of the relevant industry (PH1);*
- *carry out engineering calculations to solve complex problems and practical problems in industrial engineering (PH4);*
- *analyze engineering objects, processes and methods (PH5);*
- *choose and apply the necessary equipment, tools and methods (PH9);*
- *to apply technical control tools to assess the parameters of objects and processes in industrial engineering (PH12);*
- *to carry out engineering of technological processes for the manufacture of polymer and building materials and products (PH15);*
- *know and understand related fields (mechanics of liquids and gases, heat engineering, electrical engineering, electronics) and be able to identify interdisciplinary connections at the level necessary to fulfill the other requirements of the educational program (PH17).*

2. Pre-requisites and post-requisites of the educational component (place in the structural and logical scheme of education according to the relevant educational program)

Prerequisites: *The educational component "Mechanical Processes and Equipment for the Production of Polymer and Building Materials and Products" is based on the study of the following educational components: "Mathematics", "Physics", "Chemistry", "Mechanics of Materials and Structures", "Technology of Polymer Processing", "Machine Parts", "Hydromechanics and Hydraulics", "Heat Transfer".*

Post-details: *The educational component "Mechanical processes and equipment for the production of polymer and building materials and products" provides the following educational components: "Hydromechanical processes and equipment for the production of polymer and building materials and*

products", as well as a course project on technological equipment and course work on processes and equipment for the production of polymer and building materials and products.

3. Content of the educational component

Topic 1. General provisions on mechanical processes.

Topic 2. Crushing and grinding of solid materials.

Topic 3. Screening and classification of bulk materials.

Topic 4. Mixing bulk materials.

Topic 5. Separation of mixtures of solid bulk materials into components.

Topic 6. Clumping of hard materials.

Topic 7. Intensification of mechanical processes.

4. Training materials and resources

Basic literature

1. Mechanical processes and equipment for the production of polymer and building materials and products . 5th ed., revised. and supplemented. Kyiv : Igor Sikorsky Kyiv Polytechnic Institute, 2025. 102 p. URL: <https://ela.kpi.ua/handle/123456789/74513>.

2. Mikulionok I. O. Mechanical and hydromechanical processes, apparatuses and machines of chemical technology. Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2018. 172 p. URL: <https://ela.kpi.ua/handle/123456789/66408>.

3. Mikulionok I. O. Mechanical, hydromechanical and mass transfer processes and equipment of chemical technology. Kyiv: NTUU "KPI", 2014. 340 p. URL: <https://ela.kpi.ua/handle/123456789/38169>.

4. Processes and equipment of chemical technology. Part 1: textbook. / Y. M. Kornienko, Y. Y. Lukach, I. O. Mikulionok et al. Kyiv: NTUU "KPI", 2011. 300 p. (in Russian).

5. Processes and equipment of chemical technology. Part 2: textbook. / Y. M. Kornienko, Y. Y. Lukach, I. O. Mikulionok et al. Kyiv: NTUU "KPI", 2012. 416 p. (in Russian).

6. Mikulionok I. O. Mechanical and hydromechanical processes, apparatus and machines of chemical technology: Practicum. Kyiv: KPI. Igor Sikorsky, 2021. 174 p. URL: Access: <https://ela.kpi.ua/handle/123456789/41037>.

7. Vytvytskyi V. M., Sokolskyi O. L., Mikulionok I. O. Mechanical and hydromechanical processes and equipment for the production of polymer and building materials and products. Laboratory practicum: nauch. posob. Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2025. 42 p. URL: <https://ela.kpi.ua/handle/123456789/73644>.

Further reading

8. Mikulionok I. O. Mechanical processes, apparatuses and machines of chemical technology. Practicum on educational discipline: teaching aid. Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2019. 54 p. URL: <https://ela.kpi.ua/handle/123456789/30125>.

9. Mikulionok I. O. Classification of gravity mixers of bulk materials (survey of patents) // Chemical and Petroleum Engineering. 2020. Vol. 56, N 1–2. P. 157–164. DOI: <https://doi.org/10.1007/s10556-021-00884-2>.

10. Mikulionok I. O. Classification of Roll Grinders for Lumpy and Bulk Materials (Survey of Patents) // Chemical and Petroleum Engineering. 2021. Vol. 56, N 11–12. P. 951–957. DOI: <https://doi.org/10.1007/s10556-021-00867-3>.

11. Mikulionok I. O. Classification of the Tumbling Bodies of Rattlers (Tumbling Barrels) (Survey of Patents) // Chemical and Petroleum Engineering. 2022. Vol. 57, N 9–10. P. 885–892. DOI: <https://doi.org/10.1007/s10556-022-01021-3>.

12. Roller crushers and mills (Review of structures) / I. O. Mikulionok, A. Y. Karvatskyi, S. V. Leleka, O. I. Ivanenko // *Bulletin of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute"*; Series "Chemical Engineering, Ecology and Resource Saving". 2022. № 1(21). Pp. 30–43. DOI: 10.20535/2617-9741.1.2022.254157.

13. Grinding bodies of drum mills and crushers (Review of structures) / I. O. Mikulionok, A. Y. Karvatskyi, S. V. Leleka, O. I. Ivanenko // *Bulletin of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute"*; Series "Chemical Engineering, Ecology and Resource Saving". 2022. № 2(21). Pp. 9–21. DOI: 10.20535/2617-9741.2.2022.260339.

14. Mikulionok I. O., Ivanenko O. I. Practical use of the effects of Seebeck and Peltier (Review) // *Bulletin of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute"*: ser. "Chemical Engineering, Ecology and Resource Conservation". 2024. № 4(23). Pp. 9–34. DOI: 10.20535/2617-9741.4.2024.319010.

15. Mikulionok I. O. Use of Möbius Strip in Chemical Machine Design (Survey of Patents) // *Chemical and Petroleum Engineering*. 2021. Vol. 56, № 11–12. P. 1037–1042. DOI: <https://doi.org/10.1007/s10556-021-00880-6>.

16. Mikulionok I. O., Lukinyuk M. V. Applied application of the Mobius tape (Review) // *Bulletin of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute"*: ser. "Chemical Engineering, Ecology and Resource Conservation". 2025. № 2(24). Pp. 32–52. DOI: 10.20535/2617-9741.2.2025.333973.

17. Mikulionok I. O. Stabilization of the temperature of the working medium in the equipment of chemical plants (a survey of patents) // *Chemical and Petroleum Engineering*. 2015. Vol. 51, № 5–6. P. 324–327. DOI: 10.1007/s10556-015-0046-8.

18. Mikulionok I. O. Application of ferromagnetic materials to ensure the necessary thermal regime of technological equipment (Review) // *Energy technologies and resource saving*. 2019. № 1. Pp. 60–72 (in Russian). DOI: <https://doi.org/10.33070/etars.1.2019.06>.

19. Mikulionok I. O., Ivanenko O. I. Application of ferromagnetic materials for stabilization of the thermal regime of technological processes (Review) // *Bulletin of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute"* : ser. "Chemical Engineering, Ecology and Resource Conservation". 2024. № 3(23). Pp. 19–38. DOI: 10.20535/2617-9741.3.2024.312417.

Information resources on the Internet

20. DSpace NTB KPI them. Igor Sikorsky, <https://ela.kpi.ua/handle/123456789/38169>, <https://ela.kpi.ua/handle/123456789/41037>, <https://ela.kpi.ua/handle/123456789/30125>

21. Саїт кафедри ХПЧМ, <https://cpsm.kpi.ua/metodichni-rozrobki.html>.

22. Campus of Igor Sikorsky Kyiv Polytechnic Institute. Igor Sikorsky, <http://login.kpi.ua/>.

23. Official websites of patent offices, <https://sis.nipo.gov.ua/uk/search/simple/>, http://worldwide.espacenet.com/advancedSearch?locale=en_EP, <http://www1.fips.ru/iiss/>.

Educational content

5. Methods of mastering the educational component

Lectures

Lectures are aimed at:

- providing modern, holistic, interdependent knowledge on the educational component "Mechanical processes and equipment for the production of polymer and building materials and products", the level of which is determined by the target setting for each specific topic;
- ensuring the creative work of students together with the teacher during the lecture;
- education of students' professional and business qualities and the development of independent creative thinking;
- formation of students' necessary interest and provision of direction for independent work;
- determination at the current level of development of science in the field of the current state of mechanical processes and equipment for the production of polymer and building materials and products;
- reflection of methodological processing of the material (highlighting the main provisions, conclusions, recommendations, clear and adequate to their formulation);
- use for demonstration of visual materials;
- teaching the materials of the educational component in a clear and high-quality language in compliance with structural and logical connections, explaining all newly introduced terms and concepts;
- accessibility for perception by this audience.

No. s/p	Title of the lecture topic and a list of main questions (links to literature and tasks on the SRC)	Number of hours
1	Topic 1. General provisions on mechanical processes <i>Lecture 1. Definition and role of mechanical processes of chemical technology. Mineral processing in chemical technology.</i> <i>References: [1, 2].</i> <u>List of didactic tools:</u> The lecture uses a laptop with an electronic version of the lecture and a projector. Visual samples, diagrams and drawings for the lecture. <u>Tasks on the SRS.</u> The main types of solid minerals in chemical technology.	2
2	Topic 2. Crushing and crushing of solid materials <i>Lectures 2, 3. General provisions on crushing and grinding. Crushing and grinding hypotheses. Grinding machines, their classification.</i> <i>References: [1, 2].</i> <u>List of didactic tools:</u> The lecture uses a laptop with an electronic version of the lecture and a projector. Visual samples, diagrams and drawings for the lecture. <u>Tasks on the SRS.</u> Requirements for shredding machines	4
3	<i>Lectures 4, 5. Designs and principle of operation of jaw crushers. The main design parameters of jaw crushers.</i> <i>References: [1, 2].</i> <u>List of didactic tools:</u> The lecture uses a laptop with an electronic version of the lecture and a projector. Visual samples, diagrams and drawings for the lecture. <u>Tasks on the SRS.</u> Improvement of jaw crushers designs	4
4	<i>Lectures 6, 7. Designs and principle of operation of cone and roller crushers. The main design parameters of cone and roller crushers.</i> <i>References: [1, 2].</i> <u>List of didactic tools:</u> The lecture uses a laptop with an electronic version of the lecture and a projector. Visual samples, diagrams and drawings for the lecture. <u>Tasks on the SRS.</u> Improvement of the designs of cone and roller crushers.	4
5	<i>Lectures 8, 9. Designs and principle of operation of rotary and hammer crushers,</i>	4

No. s/p	Title of the lecture topic and a list of main questions (links to literature and tasks on the SRC)	Number of hours
	<i>combined crushers and runners, rod (finger) grinding machines. The main design parameters of runners.</i> <i>References: [1, 2].</i> <i>List of didactic tools: The lecture uses a laptop with an electronic version of the lecture and a projector. Visual samples, diagrams and drawings for the lecture.</i> <i>Tasks on the SRS. Improvement of the designs of rotary, hammer and combined crushers and runners.</i>	
6	<i>Lectures 10, 11. Designs and principle of operation of ball-ring and roller-ring pendulum mills, drum and vibration mills, centrifugal-ball and planetary mills, knife mills, millstones and paint grinders. Jet, colloidal and cavitation mills. Selection of grinders. Dispensers and feeders. Basic design parameters of drum and vibration mills.</i> <i>References: [1, 2].</i> <i>List of didactic tools: The lecture uses a laptop with an electronic version of the lecture and a projector. Visual samples, diagrams and drawings for the lecture.</i> <i>Tasks on the SRS. Improvement of the designs of dispensers and feeders of bulk materials.</i>	4
7	Topic 3. Screening and classification of solid materials <i>Lectures 12–15. General provisions for screening and classification of solid materials. Screening. Classification. Transportation of bulk materials.</i> <i>References: [1, 2].</i> <i>List of didactic tools: The lecture uses a laptop with an electronic version of the lecture and a projector. Visual samples, diagrams and drawings for the lecture.</i> <i>Tasks on the SRS: Improvement of the design of screens, conveyors, conveyors and elevators.</i>	8
8	Topic 4. Mixing bulk materials <i>Lecture 16. Mixing bulk materials. Mixing parameters.</i> <i>References: [1, 2].</i> <i>List of didactic tools: The lecture uses a laptop with an electronic version of the lecture and a projector. Visual samples, diagrams and drawings for the lecture.</i> <i>Tasks on the SRS. Improvement of the designs of mixers of bulk materials.</i>	2
9	Topic 5. Separation of mixtures of solid bulk materials into components <i>Lecture 17. Separation of mixtures of solid bulk materials. Separation methods.</i> <i>References: [1, 2].</i> <i>List of didactic tools: The lecture uses a laptop with an electronic version of the lecture and a projector. Visual samples, diagrams and drawings for the lecture.</i> <i>Tasks on the SRS. Improvement of equipment designs for separating bulk materials.</i>	2
10	Topic 6. Clumping of solid materials Topic 7. Intensification of mechanical processes <i>Lecture 18. Clumping of solid materials and intensification of mechanical processes. Modern methods and ways of intensification of mechanical processes.</i> <i>References: [1, 2].</i> <i>List of didactic tools: The lecture uses a laptop with an electronic version of the lecture and a projector. Visual samples, diagrams and drawings for the lecture.</i> <i>Tasks on the SRS. Improvement of tablet machine designs. Effective equipment for intensification of mechanical processes.</i>	2
Just		36

Practical (seminar) classes

In the system of professional training of students in this educational component, practical classes occupy 25% of the classroom load. Being an addition to the lecture course, they lay and form the foundations of the qualification of a bachelor in industrial engineering, namely polymer processing technology. The content of these classes and the methods of their conduct should ensure the development of creative activity of the individual. They develop practical thinking and the ability to use special terminology, and allow you to test your knowledge, so this type of work is an important means of prompt feedback. Practical (seminar) classes should perform not only cognitive and educational functions, but also contribute to the growth of students as creative workers in the field of industrial engineering.

The main tasks of the cycle of practical (seminar) classes:

- *to help students systematize, consolidate and deepen knowledge of a theoretical nature in the field of modern mechanical processes, devices and machines of chemical technology;*
- *to teach them to work with scientific, technical and reference literature and other sources of scientific and technical information;*
- *to form the ability to learn independently, that is, to master the methods, ways and techniques of self-study, self-development and self-control.*

No. s/p	Title of the topic of practical (seminar) classes and a list of main issues (links to literature and tasks on the SRC)	Number of hours
1	Topic 2. Crushing and crushing of solid materials <i>Practical lesson 1. Calculation of the degree of crushing of solid material and the average size of lumps (grains) of crushed material.</i> <i>References: [6, 8].</i>	2
2	<i>Practical lesson 2. Calculation of the jaw crusher.</i> <i>References: [6, 8].</i>	2
3	<i>Practical lesson 3. Calculation of a roller crusher.</i> <i>References: [6, 8].</i>	2
4	<i>Practical lesson 4. Calculation of a roller-ring pendulum mill and a drum mill.</i> <i>References: [6].</i>	2
5	<i>Practical lesson 5. Calculation of the drum rumble.</i> <i>References: [6, 8].</i>	2
6	Topic 4. Mixing bulk materials <i>Practical lesson 6. Calculation of a single-shaft continuous blade mixer for mixing bulk materials. Calculation of a cell-type drum feeder (dispenser). Calculation of the screw feeder.</i> <i>References: [6, 8].</i>	2
7	<i>Practical lesson 7. Modular control work.</i> <i>References: [1, 2].</i>	2
8	<i>Practical lesson 8. Calculation of transport pipes.</i> <i>References: [6].</i>	2
9	<i>Practical lesson 9. Calculation of the installation of pneumatic transport with a low content of bulk material.</i> <i>References: [6].</i>	2
Just		18

Laboratory classes

In the system of professional training of students in this educational component, laboratory classes occupy 25% of the classroom load. They lay and form the foundations of students' qualifications. The

content of these classes and the methods of their conduct should ensure the development of creative activity of the individual. They develop the ability to use special terminology, allow you to test knowledge, so this type of work is an important means of prompt feedback. Laboratory classes should perform not only cognitive and educational functions, but also contribute to the growth of students as creative workers.

The main tasks of the cycle of laboratory classes:

- to help students systematize, consolidate and deepen knowledge of a theoretical nature in the field of modern mechanical processes, devices and machines of chemical technology;
- to teach students to solve practical problems,
- to contribute to the improvement of skills and abilities in performing calculations;
- to form the ability to learn independently, that is, to master the methods, ways and techniques of self-study, self-development and self-control.

No. s/p	Title of the topic of laboratory work and a list of main questions (list of didactic support, references to literature and tasks on SRS)	Number of hours
1	Introductory lesson. Safety briefing. Topic 2. Crushing and crushing of solid materials Laboratory work 1 "Study of the process of fine crushing of materials in runners". References: [7].	2
2	Laboratory work 2 "Study of the parameters of the grinding process in a ball mill". Lesson 1. Study of grinding in a ball mill with load 5, 10. 15 and 20 kg grinding balls. Sieve analysis of crushed material on sieves No. 0.5 and No. 0.25. Lesson 2. Grinding study in a ball mill with a load of 20 kg grinding balls. Sieve analysis of crushed material on sieves No. 0.25, No. 0.18 and No. 0.1. References: [7].	2 2
3	Topic 3. Screening and classification of solid materials Laboratory work 3 "Study of the particle size distribution of the material by sieve analysis". Lesson 1. Grinding of the test material. Sieve analysis of crushed material on sieves No. 0.5 and No. 0.4. Lesson 2. Grinding of the test material. Sieve analysis of crushed material on sieves No. 0.31 and No. 0.25. Lesson 3. Grinding of the test material. Sieve analysis of crushed material on sieve No. 0.18 References: [7].	2 2 2
4	Topic 4. Mixing bulk materials. Laboratory work 4 "Study of the process of mixing bulk materials in a vane mixer" or "Study of energy parameters of the process of mixing viscous liquids". References: [7].	4
5	Summing up. Protection of laboratory reports	2
Just		18

6. Independent work of a student

Independent work takes 52% of the time of studying the educational component, including preparation for the exam. The main task of students' independent work is to master knowledge in areas that are not included in the list of lecture questions through personal search for information, the formation of an active interest in a creative approach in educational work. In the process of independent work within the

educational component, the student must learn to deeply analyze modern approaches to the development and implementation of the latest technologies for processing polymer materials.

No. s/p	Name of the topic submitted for independent study	Number of CPC hours
1	Topic 1. General provisions on mechanical processes Tasks for the SRS: The main types of solid minerals in chemical technology Literature [1, 2].	2
2	Topic 2. Crushing and crushing of solid materials Tasks on the CPC: Requirements for shredding machines Literature [1, 2].	2
3	Tasks on the SRS: Improvement of jaw crushers designs Literature [1, 2, 23].	6
4	Tasks on the SRS: Improvement of the designs of cone and roller crushers Literature [1, 2, 10, 12, 23].	6
5	Tasks on the SRS: Improvement of the designs of rotary, hammer, drum and combined crushers and runners References [1, 2, 11, 13, 23].	6
6	Tasks on the SRS: Improvement of the design of dispensers and feeders of bulk materials Literature [1, 2, 23].	6
7	Topic 3. Screening and classification of solid materials Tasks on the SRS: Improvement of the design of screens, conveyors, conveyors and elevators Literature [1, 2, 23].	4
8	Topic 4. Mixing bulk materials Tasks on the SRS: Improvement of the designs of mixers of bulk materials Literature [1, 2, 9, 23].	2
9	Topic 5. Separation of mixtures of solid bulk materials into components Tasks on the SRS: Improvement of equipment designs for separation of bulk materials Literature [1, 2, 23].	4
10	Topic 6. Clumping of solid materials Tasks for the SRS: Improvement of the designs of tablet machines Literature [1, 2, 23].	2
11	Topic 7. Intensification of mechanical processes Efficient equipment for intensification of mechanical processes Literature [1, 2, 23, 14–19].	4
12	Preparation for modular control work [1, 2].	4
13	Preparation for the exam [1, 2].	30
Just		78

Individual tasks

According to the working curriculum, individual tasks are not provided.

Tests

The working curriculum provides for modular control work, which is carried out in the form of a test.

7. Educational Component Policy

Rules for attending classes and behavior in the classroom

Attendance at classes is a mandatory component of assessment. Students are obliged to take an active part in the educational process, not to be late for classes and not to miss them without a good reason, not to interfere with the teacher's conduct, not to be distracted by actions that are not related to the educational process.

Rules for the implementation and defense of practical work (seminar classes):

- performance of practical work (tasks for seminar classes) takes place during the hours of practical classes and SRS and is sent to the teacher's e-mail or telegram;
- in accordance with the "Code of Honor", practical work (tasks for seminar classes) and preparation of answers to theoretical and practical questions are performed by students independently;
- The rules for the defense of practical works (tasks for seminar classes) are based on the rating system for evaluating learning outcomes.

Rules for assigning incentive and penalty points:

- Incentive points are not provided.
- Penalty points within the educational component cannot exceed 10% of the starting rating.

Deadline and retake policy

In case of debts from the educational component or any force majeure circumstances, students should contact the teacher through the available (provided by the teacher) communication channels to solve problematic issues and agree on an algorithm of actions for working out.

Academic Integrity Policy

Violation of the Code of Academic Integrity of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" is a serious violation, even if it is unintentional. The Code is available at the link: <https://kpi.ua/code.3>.

In particular, compliance with the Code of Academic Integrity means that all work on exams and tests must be done individually. When doing independent work, students can consult with teachers and with other students, but must solve problems on their own, guided by their own knowledge, skills and abilities. References to all resources and sources (e.g. in computer workshop reports, independent papers or presentations) should be clearly defined and properly designed. That is, the absence of references when using printed and electronic materials, quotes, opinions of other authors is unacceptable.

Academic Conduct and Ethics Policy

Students should be tolerant, respect the opinions of others, formulate objections in the correct form, and constructively maintain feedback in the classroom.

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". Read more: <https://kpi.ua/code.2>.

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

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

Semester	Study time		Distribution of training hours					Control measures		
	Loans	Acad. H.	Lecture	Practice.	Labor.	Ind. work	CPC	FDM	WGR	Semester certification
7	5	150	36	18	18	–	78	1	–	Exam

Current control: Reports on practical and laboratory classes, modular control work.

Calendar control: carried out twice a semester as a monitoring of the current state of fulfillment of the requirements of the syllabus.

Semester control: exam.

The student's rating in the educational component consists of the points that he receives for:

- 1) performance and defense of practical work (a total of 7 works at the teacher's choice);
- 2) performance and defense of laboratory work (6 works in total);
- 3) performance of modular control work;
- 4) answer at the exam (in writing with oral defense).

System of rating (weight) points and evaluation criteria

1. Practical classes:

Weight score – 3. Maximum number of points in all practical classes

equals: 3 points $\times$ 7=21 points.

Evaluation criteria (the solution of the problem should be received by the teacher by the end of the corresponding pair):

Score 3 is given provided that the problem is solved without errors;

Score 2 is given if the problem is solved with a minor error after correcting the corresponding error;

Score 1 is given if the problem is solved with several minor errors after correcting the corresponding errors;

A score of 0 is given if the problem is solved with a significant error, the teacher does not receive the solved problem on time (by the end of the corresponding pair) or is absent from the practical lesson without a valid reason.

In case of obtaining 0 points, the student can provide the teacher with the solution of the problem after the completion of the corresponding pair, but in order to receive positive points, the student must defend the corresponding problem to the teacher during the interview.

2. Laboratory classes:

Weight score – 4. The maximum number of points for all laboratory work is: 4 points $\times$ 6=24 points.

- Preparation for work:

Score 1 is given subject to a positive answer;

A score of 0 is given if the answer is unsatisfactory.

- performing laboratory work

point 1 is given subject to active performance of work;

A score of 0 is given in case of unsatisfactory performance of work.

- Quality of protection:

Score 2 is given subject to an excellent answer;

Score 1 is given if the answer is correct with minor errors;

A score of 0 is given if the answer is unsatisfactory.

3. Modular control work:

Weight score – 5. The maximum number of points for the test is 5 points $\times$ 1= 5 points.

Score 5 is given if at least 95% of the questions are answered;

Score 4 is given if at least 85% of the questions are answered;

a score of 3–2 is given if 75% of questions are answered;

Score 1 is given if 60% of questions are answered;

A score of 0 is given if less than 60% of the questions are answered.

Incentive points are not provided.

Penalty points are given for:

- lack of admission to laboratory work due to unsatisfactory incoming control – 1 point;
- absence from a laboratory lesson without a valid reason – 1 point;
- untimely (later than at the control lesson) defense of laboratory work – 1 point.

The total number of penalty points cannot exceed 5 (10% of the starting component).

The maximum amount of points of the starting component is 50. A prerequisite for admission to the exam is the enrollment of all laboratory work and the starting component of the rating is at least 25 points (50% of the maximum amount of points of the starting component).

According to the results of educational work for the first 7 weeks, the "ideal student" should score 20 points. At the attestation (8th week), the student receives "enrolled" if his current rating is at least 10 points.

According to the results of 15 weeks, the "ideal student" should score 40 points. At the second attestation (14th week), the student receives "enrolled" if his current rating is at least 20 points.

The maximum amount of points for the RC semester is 50:

$$RC = R_{pz} + R_{lb} + R_{micron} = 21 + 24 + 5 = 50 \text{ points.}$$

At the exam, students perform a written test. Each task contains two theoretical and one practical questions. Each theoretical question is evaluated at 20 points, and the practical question is evaluated at 10 points.

System for evaluating theoretical issues (r_{T1}, r_{T1}):

- "excellent", complete answer (at least 95% of the required information) – 20-19 points;
- "good", a sufficiently complete answer (at least 75% of the necessary information or minor inaccuracies) – 18-15 points;
- "satisfactory", incomplete answer (at least 60% of the necessary information and some errors) – 14-12 points;
- "unsatisfactory", unsatisfactory answer – 0 points.

Practical Question Evaluation System (r_{Tp}):

- "excellent", complete answer (at least 95% of the required information) – 10 points;
- "good", a sufficiently complete answer (at least 75% of the required information or minor inaccuracies) – 9-8 points;
- "satisfactory", incomplete answer (at least 60% of the required information and some errors) – 7-6 points;
- "unsatisfactory", unsatisfactory answer – 0 points.

The maximum rating of the exam test is

$$RE = RT1 + RT2 + R_{Pr} = 20 + 20 + 10 = 50 \text{ points.}$$

Conditions for admission to semester control: enrollment of all laboratory work and the starting component of the semester rating of at least 25 points.

The sum of starting points and points for the exam test work is converted to the exam grade according to the table:

Table of correspondence of rating scores to grades on the university scale:

Score	Score
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100-95	Perfectly
94-85	Very good
84-75	Well
74-65	Satisfactory
64-60	Dostagno
Less than 60	Disappointing
Not met the conditions of admission	Not allowed

9. Additional information on the educational component

List of questions submitted for semester control

Theoretical issues

1. Evaluate the crushing and grinding hypotheses.
2. Justify the determination of the particle size distribution of the bulk material mixture, sieve analysis, fractional (particle size) composition of the bulk material mixture.
3. Justify the intensification of mechanical processes.
4. Justify the number of double oscillations of the moving jaw (eccentric shaft speed), performance and energy expenditure of the jaw crusher.
5. Justify the optimal speed of rotation of the drum of the drum of the drum of the drum
6. Analyze the drum mills as well as the main design parameters of the drum ball mill (drum speed, performance and energy consumption for grinding).
7. Analyze runners and rod (finger) grinders.
8. Analyze roller crushers. To substantiate the main design parameters of double-roll crushers (grip angle, roll rotation speed, productivity and energy consumption for crushing).
9. Analyze vibrating mills as well as inertial and gyral vibrating mills.
10. Analyze centrifugal ball and planetary mills, as well as knife mills, millstones and paint grinders.
11. Analyze the hydraulic classification under the influence of gravity and centrifugal force.
12. Analyze screening, overview, types of dispersion devices, and screening efficiency.
13. Analyze the dispensers and feeders.
14. Analyze general information about screening and classification of solid materials.
15. Analyze general information about crushing and grinding solid materials.
16. Analyze the general information about classification, the phenomenon of equilibrium, free and compressed deposition.
17. Analyze the general information about shredding machines as well as the requirements for shredding machines.
18. Analyze the clumping of solid materials, agglomeration, direct clumping, briquetting and tableting.
19. Analyze the mixing of bulk materials, the parameters of the mixing process, the dependence of mixing efficiency on its intensity, as well as the design of mixers.
20. Analyze the cone crushers and the main design parameters of the cone crusher (grip angle, main shaft speed, performance and energy consumption of crushing).
21. Analyze ball-ring and roller-ring pendulum mills.
22. Analyze single and multiple screening, as well as methods of multiple screening and screen design.
23. Analyze the separation of solid material mixtures into components, as well as flotation.
24. Analyze the separation of solid material mixtures into components, as well as separation in magnetic and electric fields, chemical separation methods.
25. Analyze the separation of solid material mixtures into components, separation by external signs of lumps (grains), separation in gravitational and centrifugal force fields, and the deposition process.
26. Analyze the separation of mixtures of solid materials into components, separation by friction and shape, separation by elasticity, radiometric methods, separation on fat surfaces.
27. Analyze rotary, hammer and combination crushers.
28. Analyze inkjet, colloidal and cavitation mills. Justify the choice of shredding machines.

29. Analyze the transport of solid materials.
30. Analyze the jaw crushers as well as the crushing forces and grip angle of the jaw crusher.

Practical issues

1. Analyze the basics of calculating the degree of crushing (grinding) of solid material calculation of a drum ball mill.
2. Analyze the basics of calculating the average size of lumps (grains) of crushed material.
3. Analyze the basics of calculating a jaw crusher.
4. Analyze the basics of roller crusher calculation.
5. Analyze the basics of drum ball mill calculation.
6. Analyze the basics of calculating a roller-ring pendulum mill.
7. Analyze the basics of calculating the drum screen.
8. Analyze the calculation basics of a continuous single-shaft blade mixer for mixing bulk materials.
9. Analyze the basics of calculating a cell-type drum feeder (dispenser).
10. Analyze the basics of screw feeder calculation.
11. Analyze the basics of calculating conveyor pipes.
12. Analyze the basics of calculating the installation of pneumatic transport with a low content of bulk material.

List of questions submitted for modular control work

1. Analyze the term "degree of grinding".
2. From the original piece of cubic material, as a result of grinding, 64 cubic pieces of the same size were obtained. Justify what the degree of grinding is equal to in this case.
3. The volumetric degree of grinding of the material is 64. Justify what the degree of grinding (linear degree of grinding) of this material is equal to.
4. Explain on what basis there are crushers of coarse, medium and fine grinding.
5. Explain how the maximum number of double oscillations of the moving cheek (speed of the eccentric shaft) of the jaw crusher changes with increasing grip angle.
6. Explain the condition from which the grip angle of the jaw crusher is determined.
7. Explain from what condition the number of double oscillations of the movable cheek (speed of rotation of the eccentric shaft) of the jaw crusher is determined.
8. Explain how the performance of a jaw crusher changes as its grip angle increases.
9. Two samples of crushed materials have loosening coefficients of $\mu_1=0.4$ and $\mu_2=0.6$, respectively. Justify which of the two samples is more loosened (i.e. has a larger intergrain space).
10. Analyze whether always, when the value of the grip angle of the jaw crusher does not exceed twice the value of the friction angle of the crushed material on the material of the cheek surface, the retraction of the crushed material into the crushing chamber is guaranteed.
11. Explain why cone crushers, unlike jaw crushers, do not install fly crushers.
12. Explain the condition under which the grip angle of a roller crusher with smooth rolls is determined.
13. Explain the condition from which the rotation speed of the rolls of a roller crusher with smooth rolls is determined.
14. Explain from what condition the operating speed of the drum of a ball drum chopper is determined.
15. Analyze the term "screen efficiency".
16. Analyze how the efficiency of the screen changes with an increase in the moisture content of the dispersed material.
17. Justify how many classes (fractions) of solid bulk material are obtained by its sequential dispersion on five sieves.
18. Justify how the rate of deposition of a suspended particle during hydraulic classification under the influence of gravity depends on the viscosity of the liquid.
19. Analyze the term "mixing intensity of solid bulk materials".

20. Justify whether it is expedient to intensify the mixing process infinitely in order to increase the efficiency of mixing a mixture of solid bulk materials.

Work program of the educational component (syllabus):

Compiled by *Professor of the Department of Chemical Engineering, Doctor of Technical Sciences, Senior Researcher, Professor Mikulionok Ihor Olehovych*

Approved *by the Department of Chemical, Polymer and Silicate Engineering (Minutes No. 17 of 04.06.2025).)*

Approved *by the Methodological Commission of the Faculty of Engineering and Chemistry (Minutes No. 11 dated 27.06.2025).)*