



Extrusion 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>OPP Engineering of equipment for the production of polymer and building materials and products</i>
Status educational component	<i>Selective</i>
Form of study	<i>full-time (day)</i>
Year of training, semester	<i>4th year, spring semester</i>
Amount educational component	<i>4(120)</i>
Semester control/control measures	<i>Test</i>
Class schedule	<i>4 hours per week (2 hours of lectures, 2 hours of practical classes)</i>
Language of instruction	<i>Ukrainian</i>
Information about the course leader/teachers	Lecturer: <i>Prof., Ph.D., Sivetsky Volodymyr Ivanovych, https://cpsm.kpi.ua/sivetskij-volodimir-ivanovich.html?tmpl=component</i> Practical/Seminar: <i>Doctor of Philosophy, Associate Professor, Shvachko Denys Grigorovich, http://intellect.cpsm.kpi.ua/profile/hdg3</i>
Course placement	<i>Sikorsky Platform: https://do.ipk.kpi.ua/course/view.php?id=4395</i>

Educational component program

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

The educational component belongs to the cycle of educational components of professional training, to the educational components of professional and practical training.

Worm machines are one of the most common types of technological equipment used in the production and processing of thermoplastic polymers and composite materials.

The processing of plastics and rubber mixtures is a set of various technological processes by which the initial polymer material is transformed into a product with predetermined performance properties.

Subject of the educational component "Extrusion equipment"—is equipment for the production of molded products from thermoplastic polymers by extrusion molding. The educational component orients students to the modern world level of scientific and technical developments in the fields of application of equipment for the production of polymer and building materials.

Goal educational component «Extrusion equipment»

The purpose of this study educational component is the formation of a complex of knowledge among bachelors regarding the design features of equipment for the production of polymer and building materials and products.

In accordance with the goal, the training of bachelors in this specialty requires strengthening the 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.

ZK2 Ability to apply knowledge in practical situations. ZK4 Ability to search, process and analyze information from various sources. ZK10 Skills in using information and communication technologies. ZK12 Ability to exercise one's rights and obligations as a member of society, to realize the values of a civil (free democratic) society and the need for its sustainable development, the rule of law, the rights and freedoms of man and citizen in Ukraine. FK2 Ability to apply fundamental scientific facts, concepts, theories, principles to solve professional tasks and practical problems of the engineering industry. FK6 Ability to assess the technical and economic efficiency of typical systems and their components based on the application of analytical methods, analysis of analogues and the use of available data. FK11 Ability to analyze, select, assign processes and equipment for the production of polymer and building materials and products. FK12 Ability to perform engineering calculations on a PC using a high-level algorithmic language (Fortran, etc.)

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

- develop structural and kinematic hydraulic diagrams and drawings of machines and their components;*
- perform parametric calculations of technological equipment, as well as the strength of basic parts.*

1.2. According to the requirements of the programmed educational component "Extrusion Equipment", after mastering it, students must demonstrate the following program learning outcomes: knowledge:

- PH1 Knowledge and understanding of the principles of technological, fundamental and engineering sciences that underlie the branch of mechanical engineering of the relevant industry.*
- PH2 Knowledge and understanding of mechanics and mechanical engineering and the prospects for their development.*
- PH8 Understand appropriate methods and have the skills to design typical assemblies and mechanisms in accordance with the task.*

skills:

- PH12 Apply technical control tools to evaluate the parameters of objects and processes in industrial mechanical engineering.*
- PH19 Know and understand the features of the technology of processing polymer materials into products and parts.*

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

*Studied educational component «**Extrusion equipment**» is based on the principles of integrating various knowledge obtained by students during the bachelor's degree when studying educational components, in particular: "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 academic discipline

Introduction

Topic 1. Course goal and content. Modern design trends and requirements for polymer equipment. Structural materials and requirements for them.

Chapter 1. Worm extruders

Topic 1. Purpose and classification of extrusion machines.

Topic 2. Worms.

Topic 3. Heat supply and thermal control systems of extruders.

Topic 4. Mechanism of cork motion of bulk materials in the feeding and melting zones.

Topic 5. Mechanism of melting of thermoplastics in the screw channel of extruders.

Topic 6. Hydrodynamic analysis of flows for the viscous state of polymers in the extruder dosing zone.

Topic 7. Design of forming heads.

Topic 8. Power parameters of the extruder.

Topic 9. Structures and foundations of hull calculations.

Topic 10. Calculation of worms for strength and stiffness.

Topic 11. Roundworm barley extruders.

Topic 12. Disc and combined extruders.

4. Educational materials and resources

Basic literature

1. Extrusion equipment [Electronic resource]: a manual for bachelor's degree applicants in the specialty 131 "Applied mechanics", 133 "Industrial mechanical engineering" / Igor Sikorsky Kyiv Polytechnic Institute; compilers: V. I. Sivetsky, O. L. Sokolsky, D. G. Shvachko. – Electronic text data (1 file: 4.66 MB). – Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2025. – 144 p. – Screen title. URL: <https://ela.kpi.ua/handle/123456789/73944>
2. V.Yu. Shcherbyna, V.I. Sivetsky, O.V. Gondlyakh, Mechanical processes and equipment for the production of polymeric and building materials and products. Preparation of raw materials and equipment for mixing and molding, Textbook. Electronic edition. – K.: Igor Sikorsky Kyiv Polytechnic Institute, 2022. – 131 p. <https://ela.kpi.ua/handle/123456789/45734>
3. **V.I. Sivetsky, V.Yu. Shcherbyna, O.V. Gondlyakh**, Engineering of innovative technologies and equipment. Lines for the production of sheet and profile polymer products. Textbook. Electronic edition. – Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2022. – 113 p. URL: <https://ela.kpi.ua/handle/123456789/45732>
4. Sivetsky V. I., Radchenko L. B. Fundamentals of modeling and design of barley extruders. Educational. Kyiv: "Polytechnics", 2002. – 164 p.
5. Sivetsky V.I. Polymer processing equipment: Extrusion and pressing equipment. Lecture notes. — Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2018. — 68 p.
6. Technological equipment for the production of building and polymer products - 1. Equipment for building materials and products. Laboratory practical course on the academic discipline: a textbook / V. I. Sivetsky, V. M. Kurylenko, I. Ivitsky. — Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2018. — 45 p.
7. Sivetsky V. I. Computer design of extrusion polymer equipment. Educational center. Kyiv: "Polytechnics", 2003. – 184 p.
8. Sokolsky O.L., Sivetsky V.I. Design and calculation of forming tools and equipment for plastic processing. - K.: SPD Sichkar, 2010. – 104 p.
9. Sivetsky V.I. Sokolsky O.L. Methodical instructions for practical classes on the course Technological equipment of chemical, polymer and silicate production NTUU "KPI" 2007.

10. I.V. Kovalenko, V.V. Malynovsky, *Calculations of basic processes, machines and apparatuses of chemical production*, K.: Norita-plus, 200.-216 p.
11. V.M. Marchevsky, *Design documentation of course and diploma projects, a manual for students of higher education*. Zakl.- K.: Norita-plus, 2006.-280 p.
12. Gondlyakh O.V., Sakharov O.S., Sivetsky V.I., Shcherbyna V.Yu. *CAD. Calculations for the strength of elements of technological equipment of the chemical industry (textbook)*. K.: LLC "Polygraph Consulting", 2005, 136 p.: ill.

Additional literature

13. Dubynin A.I., Atamanyuk V.M., Duleba V.P. *Equipment of chemical production and building materials enterprises, Textbook*, Lviv Polytechnic, 2013 – 292 p.
14. Nazarenko I.I., *Machines for the production of building materials, Textbook* - Kyiv: KNUBA, 1999. – 488 p.
15. O.G. Savchenko, *Equipment of complexes for the production of building small-sized wall products, Textbook*, Kh.:2006 – 416 p.
16. I.V. Kovalenko, V.V. Malynovsky, *Basic processes, machines and apparatuses of chemical production, Textbook* K.: "Inres", "Volya", 200.-216 p.
17. *Methodological instructions for practical classes in the discipline "Equipment for the production of polymer packaging" for students of the direction of training "Engineering Mechanics". Compiled by: Sidorov D. E.* - Kyiv, 2012 - 35 p. Certificate of electronic publication of the IHF No. X 03/12-4.

Information resources on the Internet

1. **Association of Manufacturers of Profiled Polymer Products** - <https://www.bau.com.ua/f/appm/>
2. **Ukrainian Association of Polymer Products Manufacturers** - <https://opendatabot.ua/c/44034222>

Educational content

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. salary y	Title of the lecture topic and list of main questions (list of didactic aids, references to literature and tasks for the SRS)	Hours
Introduction		
	TOPIC 1.Course Objectives and Content: Modern design trends and requirements for polymer equipment. Structural materials and requirements for them. <i>Literature:[1]p. 5-8, [10] p. 10-18,</i> <i>Tasks on the CTC.Main types of polymers and their application areas</i>	1
Chapter 1.Worm extruders		
1.	TOPIC 1.Purpose and classification of worm extruders. <i>Design and principle of operation of single worms 'barley machines. Structurally technological zones.</i> <i>Literature:[1]p. 8-11, [2] p. 117-129,</i> <i>Tasks for the CTC..The essence of the extrusion method of thermoplastics, thermosets and elastomers, their rheological properties.</i>	1
2.	TOPIC 2.Worms. <i>Basic design parameters of worms for processing thermoplastics, thermosets and elastomers. Functional and design zones of worms.</i> <i>Literature[1] p. 11-15; [10] p. 123-129; 179-187;</i> <i>Tasks on the CTC. The influence of the particle size distribution and tribotechnical properties of thermoplastics on the conditions of loading and plugging in the screw channel of the extruder.</i>	2
3.	TOPIC 3.Heat supply and thermal control systems for extruders. <i>Designs of ohmic and induction electric heaters. Systems of liquid heating and cooling of housings and worms. Designs of units for supplying and removing coolant to worms.</i> <i>Literature: [1] p. 52-55, [10] p. 243-247</i> <i>Tasks on the CTC.Thermal modes of processing thermoplastics by extrusion.</i>	1

4.	TOPIC 4.Mechanism of plugging movement of bulk materials in the feeding and melting zones. <i>Equation of balance of forces acting on loose material. Productivity of worm machine in the feeding zone.</i> Literature: [1] p. 18-24, [10] p. 130-135, 143-149; <i>Tasks on the CTC.</i>Structural and technological features and functional zones of extruders and worms'yakov. Design and technological zones of worm machines.	1
5.	TOPIC 5.The mechanism of melting of thermoplastics in the screw channel of extruders. <i>The influence of temperature conditions on the melting conditions of a thermoplastic plug. The productivity of a worm machine in the zone of plug movement. The transition of thermoplastics to a viscous state in the mode of adhesion to the walls of the channel. The length of the plasticization zone of a worm machine.</i> Literature: [1] p. 25-29, [10] p. 157-164; <i>Tasks on the CTC.</i>Properties of polymers that determine the design features of the extruder melting zone.	1
6.	TOPIC 6.Hydrodynamic flow analysis for'the viscous state of polymers in the extruder dosing zone. <i>Productivity and power of the worm machine in the dosing area.</i> Literature: [3] p. 30-33, [10] p. 149-157; <i>Tasks on the CTC.</i>What design and technological parameters affect energy consumption when forming extruded polymer products?	1
7.	TOPIC 7.Design of forming heads. <i>Basic structural elements of heads. Resistance calculation. Pressure-flow characteristics of a machine with a head.</i> Literature: [1] p. 33-36, [10] p. 49-57; <i>Tasks on the SRS. Types of extrusion heads.</i>Performance characteristics of extruders with heads and worms of different geometries and lengths.	2
8.	TOPIC 8.Power parameters of the extruder. <i>Calculation of the components of the torque and thrust forces acting on the worm in different technological zones. Drive power.</i> Literature: [1] p. 36-41, [10] p. 149-157; <i>Tasks on the CTC.</i>What design and technological parameters affect energy consumption when forming extruded polymer products?	1
9.	TOPIC 9.Constructions and basics of hull calculations. <i>Fundamentals of design and calculation of solid hulls. Fundamentals of design and calculation of folding hulls. .</i> Literature: [1] p. 42-46, [10] p. 187-190; <i>Tasks for the SRS. Basic structural materials for the manufacture of hulls and requirements for them.</i>	2

10.	TOPIC 10. Calculation of worms for strength and stiffness <i>June calculation 'yaks for strength. Calculation of June 'yaks for rigidity.</i> Literature: [3] 46-48, [6] 179-187. <i>Tasks for the CRC. Basic structural materials for the manufacture of worms 'Yaks.</i>	2
11.	TOPIC 11. Two-worm 'screw, oscillating, disc and combined extruders. <i>Principle of operation and application. Design features: disc, oscillating, double-worm 'barley and combined extruders.</i> Literature: [1] 48-50, [6] 207-229. <i>Tasks on the SRS. Structural diagrams of thrust bearing assemblies and design features of the worm 'Yakuts 'barley machines.</i>	3
	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 conducting parametric calculations and thermal calculations, as well as calculations for the strength and reliability of components and parts of equipment.

The main tasks of the practical training cycle:

- help students systematize, consolidate and deepen their knowledge theoretical in the field of chemical engineering and polymer processing;
- to teach students techniques for solving practical problems, to promote the acquisition of skills and abilities for performing calculations, graphics and other types of problems;
- teach them to work with scientific and reference literature, documentation and diagrams;
- to form the ability to learn independently, that is, to master the methods, means and techniques of self-study, self-development and self-control.

No · sal ary	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)	Hours
1.	Calculation of allowable stresses in structural materials of extruder parts [3]. Tasks on the VTS. Mastering the methodology for calculating allowable stresses for structural materials of extruder working elements at different operating temperatures. Performing calculations of allowable stresses for structural materials of extruder working elements [1].	2
2.	Calculation of structural parameters of the 'yaks for processing thermoplastics. The goal of the practical lesson is to develop the ability to calculate the design parameters of the 'of extruders [1]. Tasks on the CTC. Calculation of design parameters of extruder worms for processing various thermoplastics [1].	2
3.	Calculation of the geometric shape coefficient of the extrusion head. The purpose of the practical lesson is to develop the ability to calculate the coefficient of the geometric shape of the extrusion head [1]. Tasks on the CTC. Performing the calculation of the geometric shape coefficient of the extrusion head [1]	2
4.	Calculation of the productivity of a worm press. The goal of the practical lesson is to develop the ability to calculate the productivity of a worm machine. Methodology and example of calculating the productivity of a worm machine [1].	2

	Tasks on the CTC. Performing a calculation of the productivity of a worm machine [3], [4].	
5.	Calculation of pressure drop in the extrusion die. The purpose of the practical session is to develop the ability to calculate the pressure drop in the extrusion die[3]. Methodology and example of calculating pressure drop in an extrusion die Tasks on the CTC. Performing a pressure drop calculation in the extrusion die [4].	2
6.	Calculation of the drive power of a worm machine. The purpose of the practical lesson is to develop the ability to calculate the engine power of a worm gear machine. Methodology and example of calculating the engine power of a worm machine [1]. Tasks on the CTC. Performing a calculation of the engine power of a worm machine [4].	2
7.	Calculation of the extruder worm for strength and stiffness The purpose of the practical lesson is to develop the ability to calculate the strength and stiffness of extruder worms. Methodology and example of calculating the strength and stiffness of an extruder worm [4]. Tasks on the CTC. Perform calculation June 'which is for strength and stiffness according to the specified parameters[4].	2
8.	Features of the design of housings and drives of double-worm and oscillating machines. The purpose of the practical lesson is to develop the skills of developing design schemes. Structural diagrams of hulls and auxiliary equipment[1]. Tasks on the CTC. Implementation of structural diagrams, housings and drives of double-worm and oscillating machines [3], [4].	2
9.	Modular test work.	2
	Total	18

Laboratory classes

According to the working curriculum, students are not required to perform laboratory work on the educational component "Extrusion Equipment".

Student's independent work

Independent work of students takes 70% of the time of studying the course, also includes preparation for the exam. The main task of independent work of students is to master scientific knowledge in the field of modern methods of calculating machines for tableting, rolling and calendering, 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 chemical production equipment and, based on calculations, come to their own substantiated conclusions.

No. sala ry	Title of the topic to be studied independently	Number of hours of CTC
1	2	3
Section 1. General issues in the design of polymer equipment. Introduction		

1	Tasks for the SRS. Compare the main stages of formation and development trends of the polymer engineering and polymer processing industries in Ukraine. Repeat the basic requirements for machine design. rheological and tribotechnical properties of polymers and methods for their processing into products and parts. Main types of polymers and their application. Rheological, thermophysical, tribotechnical and adhesive properties of polymers. Extrusion technology of molded polymer products. 1 [5-9], 2[10-44], 9.	20
Section 2. Worm extruders		
2	Tasks for the SRS. The principle of operation and structural diagrams of extrusion presses. The general structure and principle of operation of combined and cascade extruders. Structural and technological features and functional zones of extruders and worms'yaks. Design and technological zones. Sequence of selection of worm parameters for processing thermoplastics, thermosets and elastomers. Thermal modes of processing thermoplastics by extrusion. 1 [8-49],2[117-228].	20
3	Task on SRS. The influence of the particle size distribution and tribotechnical properties of thermoplastics on the conditions of loading and cork movement in the screw channel of the extruder. The main parameters that determine the length of the plasticization loading zones of the extruder. Dependence in 'viscosity of polymers from temperature and shear rate. Properties of polymers that determine the design features of the extruder extrusion zone. Dependence of the backpressure of the forming tool on the extruder performance. What design and technological parameters affect energy consumption when forming extruded polymer products.1 [8-49],2[117-228]	10
4	Tasks on the SRS. Features of the design parameters of the red 'for various polymer materials. Solid and collapsible extruder bodies Basic construction materials for making worms 'types and housings of extruders and requirements for them. Devices for thermal regulation of extruder working bodies. Forming heads of extrusion equipment. Filters. Coolant supply units in June 'yaks. Structural diagrams of thrust bearing assemblies and extruder drive. Hoppers, extruder dosing devices. 1 [8-49],2[117-228]	24
6	Preparation for the ICR	4
7	Preparation for the test	6
	Total hours	84

Policy and control

6. 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 works in the discipline or for additional completion of online specialized courses with obtaining the appropriate certificate:
- <https://www.coursera.org/learn/water-treatment>;
- <https://cropaia.com/water-treatment-pro/>;
- <https://www.shortcoursesportal.com/studies/56436/introduction-to-drinking-water-treatment.html>).

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

- Penalty points are not provided within the framework of the academic discipline.

Deadline and Rescheduling Policy

In the event of arrears for 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 work-out.

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 details: <https://kpi.ua/code>

7. 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 teaching hours				Control measures		
	Loans	academic year	Lectures	Practical	Lab work	CR C	MKR	RR	Semester control
8	4	120	18	18	–	84	1	–	test

A student's rating for the educational component consists of the points he receives for:

The rating for the educational component consists of the points he receives for work in practical classes and for MCR.

Rating (weighting) points system and evaluation criteria

1. Performing practical work.

Weighted score – 11. The maximum number of points for all practical work is:

11 points x 8 points/year = 88 points

Criteria for assessing student knowledge

Mark	Completeness of the answer
11-10	Timely and complete completion of the task, preparation of all programs, calculations, registration and protection without flaws

9-7	Minor flaws in the programs that do not affect the calculation results
6-4	Untimely completion of the task, shortcomings in programs, calculations and design
3-0	Failure to complete the task

2. Completion of modular test work.

Weighted score – 12 points. The modular test has two tasks, each task is evaluated at 6 points.

The maximum number of points on the modular test is:

12 points x 1 MCR = 12 points

Criteria for assessing student knowledge

Mark	Completeness of the answer
12-10	Timely and complete completion of the task, preparation of all programs, calculations, registration and protection without flaws
9-7	Minor flaws in the programs that do not affect the calculation results
6-4	Untimely completion of the task, shortcomings in programs, calculations and design
3-0	Failure to complete the task

Students who have a rating of less than 60 points at the end of the semester, as well as those who want to improve their grade, take a final exam. A "hard" system is used, where the student loses their starting rating, and the grade for the educational component is given based on the student's performance in the final exam.

At the test, students complete a written test. Each task contains two theoretical questions. The list of questions is given in the methodological recommendations for mastering the educational component. Each theoretical question is evaluated at 50 points.

Evaluation system for theoretical questions RT1, RT2 ::

"excellent", complete answer (at least 95% of the required information) – 50–48 points;

"good", sufficiently complete answer (at least 75% of the required information or minor inaccuracies) – 47–38 points;

"satisfactory", incomplete answer (at least 60% of the required information and some errors) – 37-30 points;

"unsatisfactory", unsatisfactory answer – 0 points.

The maximum rating for the test is

$RE = RT1 + RT2 = 50 + 50 = 100$ points.

Admission requirements for semester control: enrollment of all practical work.

The sum of the starting points and/or points for the credit test is converted into the credit score according to the table:

To obtain a credit score, the sum of all rating points received during the semester R is translated 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

8. Additional information on the educational component

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

Approximate list of questions that can be asked on the MCR and credit

1. Describe structural materials and requirements for them.
2. Give the classification of extrusion and pressing equipment.
3. Draw a structural and kinematic diagram of the WC.
4. Give the classification of devices for powering the FM.
5. Describe the purpose and give the classification and layout of worms. 'barley machines.
6. Describe the design and principle of operation of the CM.
7. List the structural varieties of worms 'yak extruders.
8. Draw and describe the designs of the World Cup hulls.
9. Give the method for calculating the parameters of the red Yaks.
10. Give the methodology for calculating the structural and technological parameters of the World Cup.
11. Draw the structural - layout diagrams and the principle of operation of the double worm 'barley machine.
12. Describe the design and operating principle of a disk extruder (DE).
13. Give a method for calculating the productivity of the CHM by loading area.
14. Draw and describe the design of a combined extruder.
15. Describe the distribution of the viscous flow velocity in the CH dosing zone.
16. Provide a methodology for calculating productivity by the FM dosing zone.
17. Describe the design and manufacturing technology of worms 'yak extruder.
18. Give the method of calculating the number of 'yaks for strength.
19. Draw a structural and kinematic diagram of the DE.
20. Give the method for calculating the strength of a solid hull of a CMM.
21. Draw a structural diagram of the double-worm bearing assembly 'barley machine.
22. Give the method for calculating the strength of the collapsible hull of the World Cup.
23. Draw a structural and kinematic diagram of a double-worm drive. 'barley machine.
24. Give the method of calculating the number of Yaks World Cup for rigidity.
25. Draw a structural and kinematic diagram of the PLA.
26. Draw a diagram of a device for cooling the Yaks.
27. Describe the distribution of the viscous flow velocity in the CH dosing zone.
28. Provide a methodology for calculating productivity in the World Cup traffic jam zone.
29. Give a method for calculating the productivity of the CM by dosage zone.
30. Draw the design of a combined extruder.
31. Define the extrusion process and its main advantages.
32. What is the purpose and main classification features of extrusion machines?
33. Describe the design and functions of a single-screw extruder.
34. What is an extruder worm? What are the main parameters of its geometry?
35. Describe the worm zones and their role in the polymer recycling process.
36. What is the mechanism of the cork movement of bulk materials in the feeding zone?
37. What is the mechanism of melting thermoplastics in a screw channel?
38. What heating systems are used in extruders?
39. Purpose and principle of operation of thermal control systems for extrusion equipment.
40. Hydrodynamic analysis of viscous polymer flow in the dosing zone – basic principles.
41. What are the main functions of a forming head? Its structural types.
42. The principle of operation and structure of the extruder die.
43. How are the power parameters of an extruder determined?
44. Extruder housing design and basic requirements for them.
45. Methodology for calculating worms for strength and stiffness.
46. Features of the design and operation of twin-worm extruders.
47. Types of worm interaction in two-worm machines: coherent and incoherent.

48. *What are the advantages of disc and combination extruders?*
49. *What stages does the design of an extrusion line include?*
50. *What are the requirements for polymers processed by extrusion?*
51. *Describe typical extrusion defects and ways to eliminate them.*
52. *How are parameters regulated and controlled in the extrusion process?*
53. *What software is used to calculate and model extrusion equipment?*
54. *Automated control systems for extrusion processes – purpose and components.*
55. *What are the development trends of extrusion equipment in the global industry?*

Work program educational component (syllabus):

Compiled Prof., Ph.D., Sivetsky V.I.

Approved by the department ____KhPSM____ (protocol No.17 from 04.06.2025)

Agreed Methodological Commission of the Faculty of Chemical Engineering (Minutes No. 11 dated 06/27/2025)