



PACKAGING TECHNOLOGIES AND EQUIPMENT

Work program of the educational component (Syllabus)

Details of the educational component

Higher education level	First (bachelor's)
Field of Knowledge	13 – Mechanical Engineering
Speciality	133 "Branch Engineering"
Educational program	OPP "Engineering of equipment for the production of polymer and building materials and products"
Status of the educational component	Custom
Form of study	Full-time (daytime)
Year of preparation, semester	3rd year, spring semester
Scope of the educational component	4 (120)
Semester control / control measures	Passed
Class schedule	3 hours per week (1 hour of lectures, 1 hour of practical and 1 hour of laboratory classes)
Language of instruction	Ukrainian
Information about the course leader / teachers	Lecturer: Doctor of Philosophy, Gerasymenko Yuliia Yuriivna Practical, laboratory: Doctor of Philosophy, Gerasimenko Yuliia Yuriivna
Course placement	Sikorsky Platform

Program of the educational component

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

The syllabus "Packaging Technologies and Equipment" is compiled in accordance with the educational and professional program for training bachelors of specialty 133 Industrial Engineering under the educational program "Engineering of equipment for the production of polymer and building materials and products".

The educational component belongs to the cycle of professional training.

The subject of the educational component is the development of packaging equipment, equipment of packaging lines, packaging materials and packaging process technology.

The purpose of the educational component "Packaging Technologies and Equipment"

The purpose of the educational component is to strengthen the process of forming a complex of knowledge by students on the design features and methods of calculating packaging equipment for packing, capping and labeling.

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.

General competencies:

- the ability to abstract thinking (GC 1);
- ability to search, process and analyze information from various sources (GC 4).

And:

- ability to apply fundamental scientific facts, concepts, theories, principles to solve professional problems and practical problems of industrial engineering (FC 2);
- ability to use computerized design systems and specialized application software to solve engineering problems in the field of mechanical engineering (FC 5).

In accordance with the requirements of the program of the educational component "**Packaging Technologies and Equipment**", after mastering it, students must demonstrate the following main learning outcomes:

Knowledge:

- knowledge and understanding of the principles of technological, fundamental and engineering sciences that underlie the industrial engineering of the relevant industry (PH1).

Skill:

- carry out engineering calculations to solve complex problems and practical problems in industrial engineering (PH4);
- analyze engineering objects, processes and methods (PH5);
- understand the appropriate methods and have the skills to design typical units and mechanisms in accordance with the task (PH8);
- choose and apply the necessary equipment, tools and methods (PH9).

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)

This educational component is an applied development of theoretical courses taught to students: "Higher Mathematics", "Physics", "Materials Science", "Theoretical Mechanics", "Machine Parts", "Mechanical Engineering Technology". The educational component "Packaging Technologies and Equipment" provides educational components: "Equipment for packaging and labeling", "Modernization of technological equipment" for the educational level "Bachelor" for the specialty 133 Industrial Engineering.

3. Content of the educational component

Physical and technological properties of bulk products. Status and prospects for the development of packaging equipment. Equipment for dosing bulk products. Equipment for dispensing liquid products. Equipment for dosing viscous, plastic and artificial products.

4. Training materials and resources

Basic literature

1. Gavva O.M. Packaging equipment [text]: textbook [for students of higher education] / O.M. Gavva, A.P. Bepalko, A.I. Volchko, O.O. Kokhan. – Kyiv: IAC "Upakovka", 2010. – 744 p. (in Russian).
2. Kolosov O.E. Technology of Packaging Production [textbook] / Kolosov O.E. – Kyiv, VPK "Polytechnic", 2015. – 247 p. (in Russian).
3. Packaging Equipment. Laboratory Practicum: Textbook for Students Studying in the Specialty 131 "Applied Mechanics" / Kolosov O. E., Sokolskyi O. L. Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2019. – 52 p.; Url: <https://ela.kpi.ua/handle/123456789/30182>
4. Packaging equipment. Practicum: textbook for students who study in the specialty 131 "Applied Mechanics" / Kolosov O. E., Sokolsky O. L. Kyiv: KPI. Igor Sikorsky, 2019. – 42 p.; Url: <https://ela.kpi.ua/handle/123456789/30179>

5. Packaging equipment: In 3 books. Book.3. Equipment for processing transport packages/ O.M. Gavva, A.P. Bepalko, A.I. Volchko.- Kyiv: IAC Packaging, 2006.- 96.

Further reading

1. Blagodarsky V.A. Automatic machines for food product packaging: Reference book. /V.A. Blagodarsky, N.S. Kolesnik., M.S. Zinoviev - K.: Tekhnika, 1985 - 229 p.
2. Krivoshey V.M. Packaging in our life. – Kyiv: IAC "Upakovka", 2001. – 160 p. (in Russian).
3. Gavrilchenko O.V., Shenbor V.S. Vibration conveyors for packaging equipment // Packaging. – 2002. – № 4. – P. 28–29.
4. Musiychuk V.M., Gavva O.M. Equipment for dosing viscous products // Packaging – 2002. – № 2. – P. 36–38.
5. Gavva O.M., Volotkivskiy O.M., Dembowskiy L.O. Devices for packaging plastic food products. – 2003. – № 3, 4. – P. 32–35.

Information resources on the Internet

1. Electronic Archive of KPI <https://ela.kpi.ua/>
2. Website of the Department of Chemical Engineering, <http://cpsm.kpi.ua/mr.html>
3. Electronic campus of KPI. Igor Sikorsky, <http://login.kpi.ua/>
4. Sikorsky distance learning platform <https://sikorsky-distance.kpi.ua/>
5. It is possible to conduct On-line classes using Zoom, Googlemeet, etc. platforms.
6. Packers Club of Ukraine - <http://www.upakjour.com.ua/klub-pakuvalnik%D1%96v/>
7. IAC "Packaging" - <http://www.packinfo.com.ua/>

Educational content

5. Methods of mastering the educational component

Lectures

Lectures are aimed at:

- providing modern, holistic, interdependent knowledge on the educational component "Packaging Technologies and Equipment", 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;
- acquisition of professional and business qualities by applicants and development of independent creative thinking;
- formation of students' necessary interest and provision of direction for independent work;
- determination of trends in the development of science and technology in the field of dosing of packaged products and their forecasting for the coming years;
- acquisition of skills of analysis and generalization of the material (highlighting the main ideas and provisions, emphasizing conclusions, repeating them in different formulations);
- acquisition of visual information in combination with demonstration of audiovisual materials, layouts, models and samples.

No. s/p	<i>Title of the topic of the lecture and a list of main questions (list of didactic tools, references to literature and tasks on the SRS)</i>	<i>Hours</i>
1	<i>Topic 1. Physical and technological properties of bulk products. Status and prospects for the development of packaging equipment.</i> Lecture 1. The purpose and content of the educational component. The main functions of packaging equipment in production. Classification of dosing and packaging equipment. Status and prospects for the development of packaging equipment. Lecture 2. General concepts of dosing operations. Dosage methods. Classification of dosing devices for bulk products. Features of volumetric and weight dosage. Typical design diagrams of devices for volumetric, weight and combined dosing. References: [base 1, add. 1-5]. Tasks on the CPC: Influence of external factors on the physical and technological properties of bulk products. References: [base 1, add. 1, 2-3].	4
2	<i>Topic 2. Equipment for dosing bulk and liquid products</i> Lecture 3. Physical properties of bulk products. Devices for dosing bulk products without a movable working body, with a rotating working body, with a gradual and oscillating movement of the working body. Calculation procedure. References: [base 1, add. 1, 2, 5]. Tasks on the CPS: Devices for dosing bulk products with simultaneous rotational and oscillatory movement of the working body. References: [base 1, add. 1, 2, 5]. Lecture 4. Devices for dispensing liquid products. General characteristics of liquid products and methods of their dosage. Classification of dosing devices. References: [base 1, add. 1, 4]. Tasks on CPS: Influence of external factors on the physical and technological properties of liquid products. References: [base 1, add. 1, 4]. Lecture 5. Typical design diagrams of devices for barometric suprabarometric liquid packaging. Advantages and disadvantages. Field of application. References: [base 1, add. 1, 4]. Tasks on the CPS: other design schemes of devices for barometric and suprabarometric packaging. References: [base 1, add. 1, 4]. Lecture 6. Typical design diagrams of devices for packing liquid products into containers by vacuum method. Field of application. Schematic diagrams and principle of operation of the main devices. References: [base 1, add. 1, 4]. Tasks on the CPC: other design schemes of devices for vacuum packaging. References: [base 1, add. 1, 4].	8
3	<i>Topic 3. Equipment for dosing viscous, plastic and artificial products.</i> Lecture 7. Physical properties of viscous and plastic products. Classification and typical design schemes of devices for dosing viscous and plastic products. Advantages and disadvantages. Field of application. References: [base 1, add. 1, 4]. Tasks on the SRS: other design schemes of devices for packaging viscous and plastic products. References: [base 1, appendix 1, 2, 4, 5]. Lecture 8. Procedure for calculating devices for dosing liquid, viscous and plastic products. References: [base 1, appendix 1, 2, 4, 5]. Lecture 9. Features of technological processes of packaging small-piece and artificial food products. Classification and typical design schemes of machines for packaging piece and small-piece products. Field of application. References: [base 1, add. 1, 3].	4
4	<i>Passed</i>	2

	Just	18
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Practical classes

The system of professional training of applicants for this educational component provides for practical classes, which, complementing the lecture course, contribute to the formation of knowledge and skills necessary for working with packaging technologies and equipment. The content of these classes and the methodology of their conduct should provide knowledge of methods, the ability to make calculations, allow you to test knowledge, therefore, this type of work acts as an important means of prompt feedback. Practical classes should perform not only cognitive and educational functions, but also contribute to the growth of applicants as creative workers in the field of industrial engineering.

The main tasks of the cycle of practical classes:

- to help applicants systematize, consolidate and deepen theoretical knowledge in the field of modern methods and technologies of packaging;
- to teach applicants techniques for solving practical problems, to promote the acquisition of skills and abilities in performing calculations, graphic and other tasks;
- to teach them to work with technical and reference literature and diagrams.

No. s/p	<i>Title of the topic of the practical lesson and a list of main questions (list of didactic support, references to literature and tasks on the SRS)</i>	<i>Hours</i>
1	Calculation of the rotary feeder. References: [base 1, appendix 1]. Tasks on the SRS: performing calculations according to an individual task.	2
2	Calculation of the dosing device for bulk products of the plate type. References: [base 1, appendix 1]. Tasks on the SRS: performing calculations according to an individual task.	2
3	Calculation of the dosing device for bulk products of the screw type. References: [base 1, appendix 1]. Tasks on the SRS: performing calculations according to an individual task.	2
4	Classes for the reception and defense of practical tasks.	2
5	Calculation of the belt feeder. References: [base 1, appendix 1]. Tasks on the SRS: performing calculations according to an individual task.	2
6	Calculation of the vibration feeder. References: [base 1, appendix 1]. Tasks on the SRS: performing calculations according to an individual task.	2
7	Calculation of the device for dosing bulk products of the weight type. References: [base 1, appendix 1]. Tasks on the SRS: performing calculations according to an individual task.	2
8	Classes for the reception and defense of practical tasks	2
9	Summing up	2
	Just	18

Laboratory classes

The system of professional training of applicants for this educational component provides for laboratory classes, which, complementing the lecture course, contribute to the formation of knowledge and skills necessary for working with packaging technologies and equipment. The content of these classes and the methods of their conduct should provide the skills of conducting experimental studies of packaging equipment and processing their results.

The main tasks of the cycle of laboratory classes:

- to help applicants systematize, consolidate and deepen theoretical knowledge in the field of modern methods and technologies of packaging;
- to teach applicants techniques for solving practical problems, to promote the acquisition of skills and abilities in performing research;
- to teach them to work with technical and reference literature and diagrams.

<i>No. s/p</i>	<i>Title of the topic of the laboratory lesson and a list of main questions (list of didactic support, references to literature and tasks for the SRS)</i>	<i>Hours</i>
1	Briefing on safety and familiarization of students with the program of laboratory work and laboratory equipment.	2
2	Determination of the angle of natural slope of bulk products. Processing of results and protection of work. References: [base 1, appendix 1]. Tasks for SRS: Preparation and study of the protocol for laboratory work	2
3	Determination of the volumetric mass of bulk materials. Processing of results and protection of work. References: [base 1, appendix 1]. Tasks for SRS: Preparation and study of the protocol for laboratory work	2
4	Colloquium on the reception and defense of laboratory work.	2
5	Determination of friction coefficients of packaging materials. Processing of results and protection of work. References: [base 1, appendix 1]. Tasks for SRS: Preparation and study of the protocol for laboratory work	2
6	Determination of friction coefficients of bulk materials. Processing of results and protection of work. References: [base 1, appendix 1]. Tasks for SRS: Preparation and study of the protocol for laboratory work.	2
7	Investigation of the process of dosing bulk products in a screw feeder. References: [base 1, appendix 1]. Tasks for SRS: Preparation and study of the protocol for laboratory work.	2
8	Colloquium on the reception and defense of laboratory work.	2
9	MCR	2
	Just	18

6. Independent work of a student

Independent work takes 55% of the time to study the educational component, including preparation for the exam. The main task of independent work of applicants is to master scientific 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 framework of the educational component, the applicant must learn to deeply analyze modern approaches to the development and implementation of the latest packaging technologies, based

on the characteristics of water and the requirements for the quality of packaged products. He must be able to create the most effective methods and means of packaging.

No. s/p	Name of the topic submitted for independent study	Number of CPC hours
1	Topic 1. Equipment for dosing bulk products. Tasks on the CPC: Influence of external factors on the physical and technological properties of bulk products. References: [base 1, add. 1, 2]. Gravity dispensers with aeration aids. References: [base 1, appendix 1, 2]. Devices for dosing bulk products with simultaneous rotational and oscillatory movement of the working body. References: [base 1, add. 1, 2-4].	23
2	Topic 2. Equipment for dosing liquid, viscous, plastic and artificial products. Tasks on CPS: Influence of external factors on the physical and technological properties of liquid products. References: [base 1, add. 1, 4-6]. Other design diagrams of devices for barometric packaging. References: [base 1, add. 1, 4-6]. Other design diagrams of devices for vacuum packaging. References: [base 1, add. 1, 4-6]. Other design diagrams of devices for suprabarometric packaging. References: [base 1, add. 1, 4-6]. Other design diagrams of devices for packaging viscous products. References: [base 1, add. 1, 4-6]. Other design diagrams of devices for packaging plastic products. References: [base 1, add. 2, 4-6].	33
3	Preparation for the MCR	4
4	Preparation for the test	6
	Just	66

7. Individual lessons

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

Policy and control

8. Educational Component Policy

Rules for attending classes and behavior in the classroom

Attendance at classes is a mandatory component of assessment. Applicants 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 not related to the educational process.

Rules for assigning incentive and penalty points

- incentive points are not provided;
- penalty points are provided according to the RSO.

Deadline and retake policy

In case of debts from the educational component or in the presence of force majeure, applicants must timely contact the teacher through the communication channels provided by him to resolve problematic issues and agree on the procedure for their processing.

Academic Integrity Policy

Plagiarism and other forms of dishonest work are unacceptable. Plagiarism includes the absence of references when using printed and electronic materials, quotes, opinions of other authors. Hints and cheating are unacceptable when writing tests, conducting classes; passing the test for another applicant; 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". Read more: <https://kpi.ua/code>

Academic Conduct and Ethics Policy

Applicants should be tolerant, respect the opinion of others, formulate objections in the correct form, and constructively support 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>

9. 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	Practical	Lab. Rob.	SRS	MCW	RR	Semester control
6	4	120	18	18	18	66	1	–	Passed

The student's rating in the educational component consists of the points that he receives for work in practical, laboratory classes and the implementation of the MCW

*Semester control is **a test**.*

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: credit.

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

- 1) performance and defense of practical work (6 works in total);
- 2) performance and defense of laboratory work (a total of 5 works at the teacher's choice);
- 3) performance of modular control work.

System of rating (weight) points and evaluation criteria

1. Practical classes:

Weight score – 8. The maximum number of points in all practical classes is:

8 points × 6 = 48 points.

Evaluation criteria:

Score 8 is given provided that the problem is solved without errors;

Score 6 is given if the problem is solved with a minor error;

a score of 3-4 is given if the problem is solved with several errors;

A score of 0 is given provided that the problem is solved with a significant error or is absent from the practical lesson without a valid reason.

2. Laboratory classes:

Weight score – 8. The maximum number of points for all laboratory work is:

8 points × 5 = 40 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:

a score of 3 is given subject to an excellent answer;

Score 2 is given subject to the correct answer with minor errors;

Score 1 is given if the answer is with certain errors;

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

3. Modular control work:

Weight score – 6. The maximum number of points for the test is 6 points × 2 questions = 12 points.

a score of 12 is given if at least 95% of the questions are answered;

Score 9 is given if at least 85% of the questions are answered;

Score 8 is given if 75% of questions are answered;

a score of 6-7 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) delivery of laboratory work – 1 point.

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

The maximum amount of points is 100. A prerequisite for admission to the test is the enrollment of all laboratory work.

According to the results of academic work for the first 7 weeks, the "ideal student" should score 40 points. At the attestation (8th week), the student receives "enrolled" if his current rating is at least 20 points.

According to the results of 15 weeks, the "ideal student" should score 80 points. At the second attestation (14th week), the student receives "enrolled" if his current rating is at least 40 points.

The maximum amount of points for the RC semester is 100:

$$RC = R_{pz} + R_{lb} + R_{mkr} = 48 + 40 + 12 = 100 \text{ points.}$$

To receive a test from the educational component "automatically", you need to have a rating of at least 60 points and pass all practical, laboratory work.

Students who score on the grade scale of **F** (40 points or less) are not allowed to take the test and must increase their rating.

Students who received 41-59 points (**Fx grade**), or those who want to increase their grade, perform a test test. At the same time, the points scored during the semester are canceled.

On the test, students perform a written test work. 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.

Question evaluation system:

- "excellent", complete answer (at least 95% of the required information) – 48-50 points;
- "good", a sufficiently complete answer (at least 75% of the necessary information or minor inaccuracies) – 38-47 points;
- "satisfactory", incomplete answer (at least 60% of the required information and some errors) – 30-37 points;
- "unsatisfactory", unsatisfactory answer – 0 points.

The maximum rating of the test test is

$$RE=RT1 + RT2 = 50 + 50 = 100 \text{ points.}$$

Conditions for admission to semester control: enrollment of all laboratory work and a rating of at least 40 points.

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

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

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

10. Additional information on the educational component

TEST QUESTIONS

1. Name the stages of the technological process of packaging and equipment for their implementation.
2. Give a classification of packaging equipment.
3. To classify the dosing devices for bulk products.
4. Give typical design diagrams of devices for weight dosing of bulk products, indicate their advantages and disadvantages.
5. To give typical design diagrams of devices for dosing bulk products without movable working bodies, to indicate their advantages and disadvantages.
6. To give typical design diagrams of devices for dosing bulk products with translational movement of working bodies, to indicate their advantages and disadvantages.

7. Give typical design diagrams of disk and lock devices for dosing bulk products, indicate their advantages and disadvantages.
8. Give typical design diagrams of plate and screw devices for dosing bulk products, indicate their advantages and disadvantages.
9. To give typical design diagrams of devices for dosing bulk products of oscillatory action, to indicate their advantages and disadvantages.
10. Specify the criteria for assessing the dosage error.
11. Classify the dosing devices for liquid products.
12. Indicate the principles and uses of methods for dosing liquid products by driving force.
13. To give typical design diagrams of devices for barometric packaging of liquid products by volume and weight, to indicate their advantages and disadvantages.
14. To give typical design diagrams of devices for barometric packaging of liquid products by level, to indicate their advantages and disadvantages.
15. Give hydraulic schemes for filling containers with liquid products, indicate their advantages and disadvantages.
16. Give typical design diagrams of devices for packaging liquid products into bottles by vacuum, indicate their advantages and disadvantages.
17. Give typical design diagrams of devices for packaging liquid products in bottles in a superbarometric way, indicate their advantages and disadvantages.
18. Indicate the physical properties of viscous products and give a classification of devices for their dosing.
19. Give typical design diagrams of devices for dosing viscous products, indicate their advantages and disadvantages.
20. Indicate the physical properties of plastic products and give a classification of devices for their dosing.
21. Give typical design diagrams of screw devices for dosing plastic products, indicate their advantages and disadvantages.
22. Give typical design diagrams of piston devices for dosing plastic products, indicate their advantages and disadvantages.
23. Specify the features of vacuum, aseptic packaging and packaging in a changed gas environment.
24. To classify and indicate typical design schemes of machines for packaging piece products, their advantages and disadvantages.
25. To give a method for calculating a gravity feeder for bulk products.
26. Give a method for calculating the productivity of a rotary feeder.
27. Give a method for calculating the power of a rotary feeder.
28. Give a method for calculating the screw feeder.
29. Give a method for calculating a belt feeder.
30. Give a method for choosing the frequency of vibration of the vibration feeder.

LIST OF TASKS FOR MODULAR CONTROL WORK

1. To characterize the operations of the technological process of packaging.
2. Determine the mean square deviation and coefficient of variation to assess the accuracy of weight dosing, if the samples taken showed the following mass values: $m_i = 100.1; 98.6; 99.3; 98.9; 101.2$ g.
3. Select the frequency of vibration of the vibration conveyor, if the length of the chute is 1.3 m with a working weight of 90 kg, and the use of electronic devices is unacceptable.
4. To classify automatic weighing dispensers of continuous action by the type of actuator that regulates productivity.
5. To characterize the assessment of the dosing error of continuous weighing dispensers
6. To classify dosing devices for bulk products by type of movement and type of working bodies

7. To give a classification of automatic weighing dispensers of continuous action by the type of measuring element.
8. Determine the minimum number of samples and the coefficient of variation to assess the accuracy of weight dosing, if the mean square deviation of the mass in the samples taken turned out to be equal to $S = 2$ g, the average mass of the material in the samples $\bar{m} = 101$ g, the allowable error is $\Delta = 0.03$, for which the parameter of the Laplace function t_s is taken to be equal to 0.00225.
9. Determine the performance of the screw feeder if the outer diameter of its turns is equal to the winding pitch and is 30 mm, the shaft diameter is 10 mm, the cross-sectional filling factor $\lambda = 0.4$, the number of shaft revolutions $n = 2$ rpm.
10. To provide a classification of dosing devices for liquid products for packaging at different pressure levels.
11. Describe Newton's law for ideal fluids.
12. To classify dosing devices for liquid products by type of shut-off valves.
13. To give a classification of dosing devices for liquid products according to the container filling scheme.
14. Select the frequency of vibration of the vibration conveyor, if the length of the chute is 1.2 m with a working weight of 120 kg. The noise level should be low.
15. Determine the viscosity of a fluid if the shear rate in it is $\dot{\gamma} = 200 \text{ s}^{-1}$, and the tangent stress $\tau = 4 \cdot 10^3 \text{ Pa}$, provided that: a) the fluid is Newtonian, b) the fluid is pseudoplastic, c) the fluid is viscoplastic, the initial shear stress is $\tau_0 = 1000 \text{ Pa} \cdot \text{s}$.
16. Compare the dependencies of Newton's law for fluids with the power law. In which case do they coincide?
17. To classify dosing devices for viscous products by type of working body.
18. Determine the performance of the screw feeder if the outer diameter of its turns is equal to the winding pitch and is 50 mm, the diameter of the shaft is 10 mm, the filling factor of the section $\lambda = 0.3$, the number of shaft revolutions $n = 1$ rpm.
19. Determine the tangential stress in a fluid if the shear rate in it is $\dot{\gamma} = 400 \text{ s}^{-1}$, provided: a) Newtonian fluid, viscosity $\eta = 20 \text{ Pa} \cdot \text{s}$, b) pseudoplastic liquid, flow index $n = 0.5$, consistency coefficient $K = 2000 \text{ Pa} \cdot \text{s}$, c) viscoplastic liquid, viscosity $\eta = 40 \text{ Pa} \cdot \text{s}$, initial shear stress $\tau_0 = 2000 \text{ Pa} \cdot \text{s}$.
20. To classify dosing devices for viscous products by type of shut-off valves.

Work program of the educational component (syllabus):

Compiled by Assistant Professor, Doctor of Philosophy, Gerasymenko Y.Y.

Approved by the Department of ____CPSM____ (Minutes No. 17 dated 04.06.2025)

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