Mechanics of the working environment and processes

Work program of the discipline (Syllabus)

Details of the discipline

Level of higher education	***Third (educational and scientific)***
Branch of knowledge	*13 Mechanical engineering*
Specialty	*133 Industrial engineering*
Educational program	*Computerized printing systems*
Discipline status	*Selective*
Form of study	*full-time (day) / full-time (evening) / part-time / remote / mixed*
Year of preparation, semester	*2nd year, spring semester*
The scope of discipline	*5 (150)*
Semester control / control measures	*Test*
Timetable	*2 hours per week (1 hour of lectures and 1 hour of practical classes)*
Language of instruction	*Ukrainian*
Information about course leader / teachers	Lecturer: Prof., Dr. those. Sciences Shevchuk Anatoly Vasilyevich *AnatoliiShevchuk.52@icloud.com,,* **https://www.fasebook.com/vpi.mapv/; t.me/mapv vpi** Practical / Seminar: Associate Professor, Ph.D. those. Sciences Ivanko Andrey Ivanovich,ivanko-a@ukr.net https://orcid.org/0000-0002-4735-9665
Course placement	https://osvita.kpi.ua (section "Educational programs") http://vpi.kpi.ua http://mapv.vpi.kpi.ua (section "Educational programs")

Curriculum of the discipline

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

The task of the printing and packaging industry is to automate the processes of feeding and loading of sheet materials, as well as the use of high-performance processing sections of semi-finished products.

The speed characteristics for the flow production of printing semi-finished products are constantly increasing. The means of their transportation are being improved and new continuous methods of their processing are being developed. In most cases, cutting modules must perform technological operations of trimming certain parts of semi-finished products during their transportation.

Thus, advanced modules must be equipped with high-performance combined mechanisms, means of separation of semi-finished products, devices for feeding them into the processing and output zone. And solving the problem of high-quality positioning of semi-finished products in the work area is an urgent issue today. Therefore, increasing the speed characteristics of the means of transportation of book and magazine blocks with their simultaneous accurate positioning in the trimming area will increase the productivity of the production line as a whole.

Automation of technological equipment for printing and packaging production requires solving complex problems. In connection with the intensive introduction of industrial robots, scientific work is being carried out to create innovative designs of devices that provide reliable loading and unloading of semi-finished products in production lines.

Known methods of designing loading and transporting devices based on the use of mechanical, vacuum, magnetic, pneumatic, clamping, etc. elements. However, the use of pneumatic equipment is one of the promising areas for solving the problems of transport and loading operations of flow production. Additionally, the technology eliminates direct contact directly in the working environment of the product and the gripper. And also provides a wide range of efforts and speeds of movement of products of various density and weight.

For preparation of semi-finished products and installation on the transport conveyor it is necessary to define technical and operational requirements to exciting means. Considering the object of transportation - semi-finished product (its physical condition, shape, signs of symmetry, mobility and orientation at the time of capture).

A large number of traditional cutting equipment is used for the processing of semi-finished products, namely the cutting of sheet materials. The technological process of cutting sheet material can occur during the eaves, or during its movement. The use of marble-free pruning technology implies the absence of marzan.

The combined processes that occur between technological operations significantly affect the productivity of printing and packaging machines. Thus, the process of transporting the sheet material begins with its separation from the stack, moving to the processing area and display on the receiving table.

IN in the processing area of sheet materials the most technologically complex operation is trimming. Sheet-cutting, single-knife and cardboard-cutting machines are used for cutting semi-finished products.For example, the screw cutting tools of the rotary die-cutting module allow for a curvilinear separation of the cardboard scan. The geometry of each blade depends on the angle of elevation of the helix, the axial pitch and the length of the cutting line (length of cut).

Studies of technological processes in combined pneumatic modules allow us to study the specific working environment in which they occur. Additionally, determine the air flow rate, temperature variables of the characteristic working fluid in the area of the pneumatic cutting or cutting section.

The subject of the discipline "Mechanics of the working environment and processes" *- implementation of the approach to the definition and use of methods of scientific knowledge using the laws of logic and rules of scientific research.* The solution of the set tasks will be determined by the level of training of specialists working in the printing industry, scientific institutions and organizations, enterprises of printing engineering.

The purpose of the discipline "Mechanics of the working environment and processes"

The purpose of studying this discipline is to form in graduate students a set of knowledge in the field of modern technologies, scientific developments in mechanical engineering, a set of skills needed to conduct research in this area, to create modern and new methods and technologies. In accordance with the purpose of training doctors of philosophy in this specialty requires strengthening the competencies formed in graduate students:

- *ability to conduct critical analysis, evaluation and synthesis of new ideas;*
- *ability to develop and implement projects, conduct their own research;*
- *based on determining the technical condition of the equipment of existing industries, the ability to modernize and develop effective measures to improve technical and technological processes.*

*According to the requirements of the program of the discipline "**Mechanics of the working environment and processes**», students after mastering it must demonstrate the following program learning outcomes:*

- to know the priority state directions of development of science, equipment and technologies in professional and related fields;

- professionally process, analyze, summarize and scientifically substantiate the scientific results of research on the production of new and innovative technical solutions;

- to carry out scientific research, to be ready for effective and successful scientific activity, to provide search activity, productive research behavior, steady desire for creative scientific research.

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

*Study of the discipline «**Mechanics of the working environment and processes**»Is based on the principles of integration of various knowledge acquired by graduate students during master's studies in the study of natural sciences and engineering. Discipline must providesolving complex problems in the field of industrial engineering and is aimed at a deep rethinking of existing and the creation of new holistic knowledge and professional practice.*

3. The content of the discipline

Section 1. Inkjet feeders of sheet materials.

Topic 1. Jet and vacuum suction cups. Accuracy of base of semi-finished products.

Topic 2. Dynamic characteristics of the process of separation and movement of semi-finished products.

Section 2. Continuous processing of printing semi-finished products.

Topic 3. Transportation of printing semi-finished products in the area of their processing. Devices of modular structure.

Topic 4. The main technological characteristics of the process of transportation of semi-finished products. Reversible movement of semi-finished products.

Section 3. Designs of gripping devices for piece loading of semi-finished products.

Topic 5. Vacuum-type gripping devices used in industry. Analysis of the use of the design of jet type grippers with a developed end and slot type surface.

Topic 6. Methods of analytical calculation of optimal parameters of invaders. Recommendations for the choice of design and technological parameters of jet grippers.

Section 4. Frost-free technologies for cutting sheet materials.

Topic 7. Frost-free methods of cutting sheet materials. Use of an air bag in the working area of the transportation system. Pneumatic conveying system and the principle of its operation.

Topic 8. Disk cutting tools module for cutting semi-finished products. Contactless sheet grabber. Pneumatic chamber. Aerodynamic effect.

Section 5. Trimming of sheet materials in pneumatic conveying systems.

Topic 9. Retention and transportation of sheet material in the cutting area due to the vacuum chamber Non-freezing method of cutting sheet material.

Topic 10. The system of alignment and positioning of sheet material.

Section. 6. Modeling of air flow processes in pneumatic marzan chambers of the die-cutting module.

Topic 11. Modeling of the process of air flow in the chamber of the pneumatic marzan of the rotary die-cutting module. Screw knives of the rotary die-cutting module. Curvilinear division of a cardboard scan. The geometry of the blade of the cutting tool. Height of the helix, axial pitch and length of the cutting line. Cutting force of curvilinear scan and resistance force.

Topic 12. Volumetric air flow and its variable temperature. Peak air flow. Dependence of air flow in the area of cutting cardboard scans on its temperature.

Section 7.*Rotary cutting of cardboard scans using pneumatics. Eruption of various holes in cardboard consumer packaging.*

Topic 13. Sheet material and its wrinkling. Working contact area between the blades and the material. Change the positioning of the sheet. Displacement phenomena. The area of contact between the cutting arc lines and the cutting material. Friction forces. The process of "stretching" the sheet through the cutting area. Curvature and deformation of the sheet.

4. Training materials and resources

Basic literature

1. Киричок П.О. Special methods of scientific research: textbook. under the program "Doctor of Philosophy" for tech. special un-tu / P.O. Киричок, C.B. Strutynsky, VG Oiler; Nat. tech. University of Ukraine "Kyiv Polytechnic Institute". - Kyiv: ArtEk Publishing House, 2016. - 594 p.
2. Kulchytska HB Workshop on the design of publishing and printing processes: textbook. manual for students of higher educational institutions / H.B. Kulchytska, LS Ancestor. - Lviv: Ukrainian Academy of Printing, 2016. - 200 p.
3. Onysyk S. Modeling of control objects. Concept. Interpretation. Models. Research: textbook. Manual / Stefan Onysyk. - Lviv: Lviv Polytechnic Publishing House, 2019. - 292 p.
4. Rivak PM, Shabliy IV Workshop on the technology of printing processes: teaching method. way. Lviv: UAD, 2018. 184 p.
5. Pistun E. Fundamentals of automation and automation: textbook. manual / Eugene Pistun, Ivan Stasiuk. - 2nd ed., Changes. and add. - Lviv: Lviv Polytechnic Publishing House, 2018. - 336 p.
6. Mechanics of continuous environments - 1. Mechanics of continuous environments in engineering calculations [Electronic resource]: Text of lectures for students majoring in "Industrial Engineering", specialization "Engineering, equipment and technology of production of polymeric and building materials and products" / Compiled by: O. C. Sakharov, AE Karvatsky - K .: KPI. Igor Sikorsky, 2017. - 233 p.
7. Vasylkivsky IS Actuators of automation systems: textbook. manual / IS Васильківський, B.O. Fedinets, Ya.P. Yusik. - Lviv: Lviv Polytechnic Publishing House, 2020. - 220 p.
8. Makarenko RO Hydrogas mechanics: textbook. Manual / R.O. Макаренко, О.Д. Koval, OI Whistle. - К .: НАУ, 2016. - 220 с.
9. Dubovoy VM Modeling and optimization of systems: a textbook / V.M. Дубовой, P.H. Kvetny, OI Михальов, A.B. Mustache. - Vinnytsia: PE "TD" Edelweiss ", 2017 - 804 p.

Additional literature

10. Folding practice: from strip descent to finished products. Folding systems Heidelberg Finishing: textbook. allowance. / [Karpenko VS, Shostachuk YA, Sysyuk VG etc.]. - K .: UkrNDISVD "Technology", 2001. - 240 p.
11. Kipphan. G. Encyclopedia of print media. Technologies and methods of production / Per. with him. - M .: МГУП, 2003. - 1280 с.
12. Regey II Consumer cardboard packaging (materials, design, manufacturing equipment): textbook. way. / Ivan Ivanovich Regey. - Lviv: UAD, 2011. - 144 p.
13. Against. Ya.I. Capture devices for industrial robots: A textbook. / Я.І. Against - Ternopil: TSTU. I. Pulyuya, 2008. - 232 p.
14. Yuryeva AV Calculation of vacuum systems: a textbook / AV Yuryeva. - Tomsk: Tomsk Polytechnic University Publishing House, 2012. - 114 p.

Information resources on the Internet

15. https://ips.ligazakon.net/document/TM022148
16. https://www.festo.com/

Educational content

5. Methods of mastering the discipline (educational component)

Lectures

Lectures are aimed at:

- *providing modern, holistic, interdependent knowledge in the discipline "Mechanics of the working environment and processes";*
- *providing creative work of postgraduate students together with the teacher during the lecture;*
- *education of postgraduate students of professional and business qualities and development of their independent creative thinking;*
- *formation of the necessary interest in graduate students and providing direction for independent work;*
- *reflection of methodical processing of material (selection of the main provisions, conclusions, recommendations, clear and adequate to their formulations);*
- *use for demonstration of visual materials, combination, if possible, with demonstration of results and samples.*

№ s / n	*Title of the lecture topic and list of main questions (list of teaching aids, references to literature and tasks on VTS)*	*Hours*
1	***Jet and vacuum elements. Accuracy of base of semi-finished products*** *Tasks and tasks printing and packaging industry to automate the processes of separation, movement into the processing area and removal of semi-finished products.* *Literature: [1, 2, 3, 4, 5, 6, 7].* *Tasks on VTS. Use of high-performance sections of processing of semi-finished products*	*1*
2	***Dynamic characteristics of the process of separation and movement of semi-finished products*** *The question of separating the sheet materials from the stack. Research of the principle of operation of jet elements. Design solutions for automatic feeders.* *Literature: [1, 2, 3, 4, 5].* *Tasks on VTS. Automation of processes of giving and loading of sheet semi-finished products in the printing, machine-building, instrument-making, light and other industries.*	*1*
3	***Transportation of printing semi-finished products in the area of their processing. Devices of modular structure*** *Characteristics of flow production of printing semi-finished products. Continuous processing methods. Improvement of production modules. High-performance combined mechanisms. Means of separation of semi-finished products* *Literature: [4, 6, 7, 8, 9].* *Tasks on VTS. Production lines, insert-sewing-cutting units. Universal transport and cutting modules.*	*2*

4	***The main technological characteristics of the process of transportation of printing semi-finished products. Reversible movement of semi-finished products*** *Modeling by means of automated design of SolidWorks transport module drive.* *Literature: [4, 6, 7, 8, 9].* *Tasks on VTS. Use of mechanisms of reversible action. Dimensions of devices and elements of the conveyor.*	*2*
5	***Vacuum-type gripping devices used in industry*** *Analysis of the use of the design of jet type grippers with a developed end and slot type surface.* *References: [3, 4, 5, 9, 11, 12, 13, 14, 16].* *Tasks on VTS. Transport and loading mechanisms with high operational reliability and productivity. Automatic download tools.*	*2*
6	***Methods of analytical calculation of optimal parameters of invaders*** *Recommendations for the choice of design and technological parameters of jet grippers.* *References: [3, 4, 5, 9, 11, 12, 13, 14, 16].* *Tasks on VTS. Static and dynamic characteristics of the capture process of brittle, flexible, non-rigid, coated and other semi-finished products.*	*1*
7	***Frost-free methods of cutting sheet materials*** *Use of an air bag in the working area of the transportation system. Pneumatic conveying system and the principle of its operation.* *References: [4, 6, 7, 9, 12, 13, 14].* *Tasks on VTS. Classic methods of trimming printing semi-finished products.*	*1*
8	***Disk cutting tools of the module for cutting of semi-finished products*** *Contactless sheet grabber. Pneumatic chamber. Aerodynamic effect.* *References: [4, 6, 7, 9, 12, 13, 14].* *Tasks on VTS. Cutting tools in bookbinding machines*	*2*
9	***Retention and transportation of sheet material in the cutting area due to the vacuum chamber*** *Unmarried method of trimming sheet material.* *Literature: [3, 4, 5, 6, 7, 9, 14].* *Tasks on VTS. Productivity of executive units of printing and packing machines.*	*1*
10	***Sheet material alignment and positioning system*** *Pneumatic chamber. Creating the necessary pressure. Determining the time for keeping and transporting the selected sheet material.* *Literature: [3, 4, 5, 6, 7, 9, 14].* *Tasks on VTS. Technological and parametric characteristics of the vacuum chamber.*	*1*
11	***Simulation of the air flow process in the pneumatic marzan chamber of a rotary die-cutting module*** *Screw knives of the rotary die-cutting module. Curvilinear division of a cardboard scan. The geometry of the blade of the cutting tool. Height of the helix, axial pitch and length of the cutting line. Cutting force of curvilinear scan and resistance force* *References: [4, 6, 7, 8, 9, 10, 11, 16].*	*1*

	Tasks on VTS. Equipment for the manufacture of cardboard packaging. Sections and devices for cutting, cutting and felling.	
12	***Volumetric air flow and its variable temperature*** *Peak air flow. Dependence of air flow in the area of cutting cardboard scans on its temperature* *References: [4, 6, 7, 8, 9, 10, 11, 16].* *Tasks on VTS. Production of various cardboard packages. Technological process of cutting in the zone "knife-counter knife".*	*2*
13	***Sheet material and its crumpling. Working contact area between the blades and the material.*** *Change the positioning of the sheet. Displacement phenomena. The area of contact between the cutting arc lines and the cutting material. Friction forces. The process of "stretching" the sheet through the cutting area. Curvature and deformation of the sheet* *References: [4, 7, 9, 10, 11, 12].* *Tasks on VTS. Cardboard and its physical and mechanical properties*	*1*
	Total	***18***

Practical training

In the system of professional training of graduate students in this discipline, practical classes occupy 50% of the classroom workload. As a supplement to the lecture course, they lay and form the basis of the qualification of Doctor of Philosophy in the field of printing engineering. The content of these classes and the methods of their conduct ensure the development of creative activity of the individual. They are aimed at the development of scientific thinking and the ability to use special terminology, allow you to test the knowledge gained. This type of work is an important means of prompt feedback. Practical classes perform not only a cognitive and educational function, but also contribute to the growth of graduate students as creative workers and researchers.

The main tasks of the cycle of practical classes:

- *help postgraduate students to systematize, consolidate and deepen theoretical knowledge in the field of modern methods and technologies of printing production;*
- *to teach graduate students techniques for solving practical problems, to promote the acquisition of skills and abilities to perform calculations, graphics and other tasks;*
- *to teach to work with scientific and reference literature and schemes;*
- *to form skills learn independently, ie master the methods, techniques and techniques of self-learning, self-development and self-control.*

№ s / n	***The name of the topic of the practical lesson and a list of basic questions (list of didactic support, references to literature and tasks on VTS)***	***Hours***
1	***Design of jet and vacuum systems for transportation of printing semi-finished products*** *Automation of printing and packaging industry. Processes of separation, transfer to the processing area and removal of semi-finished products.* *Literature: [1, 2, 3, 4, 5, 6, 7].* *Tasks on VTS. Performance of operating equipment*	*2*
	Calculation of dynamic characteristics of the process of separation and movement of semi-finished products	

	Research of the principle of operation of jet elements. Design solutions for automatic feeders. *Literature: [1, 2, 3, 4, 5].* *Tasks on VTS. Automation of processes of giving and loading of sheet semi-finished products.*	
2	***Modeling of modular devices*** *Technological characteristics of the continuous processing method. Calculation of means of separation of semi-finished products* *Literature: [4, 6, 7, 8, 9].* *Tasks on VTS. Production line performance.*	*2*
3	***Application of reversible movement of semi-finished products during their processing.*** *Modeling by means of automated design of SolidWorks transport module drive.* *Literature: [4, 6, 7, 8, 9].* *Tasks on VTS. Mechanisms of reversible action.*	*2*
4	***Modeling of vacuum gripping devices*** *The design of jet type grippers with a developed surface of the end and slot type.* *References: [3, 4, 5, 9, 11, 12, 13, 14, 16].* *Tasks on VTS. Automatic download tools.*	*2*
5	***Calculation of optimal parameters of invaders*** *Selection of design and technological parameters of jet captures.* *References: [3, 4, 5, 9, 11, 12, 13, 14, 16].* *Tasks on VTS. Static and dynamic characteristics of the process of capturing semi-finished products.*	*2*
	Modeling of the frost-free method of cutting sheet materials *Airbag in the working area of the transportation system. Pneumatic conveying system.* *References: [4, 6, 7, 9, 12, 13, 14].* *Tasks on VTS. Calculation of the technological process of trimming the working area of the stack of sheets.*	
6	***Calculation of the technological process of cutting semi-finished products with disk cutting tools*** *Contactless sheet grabber. Pneumatic chamber. Aerodynamic effect.* *References: [4, 6, 7, 9, 12, 13, 14].* *Tasks on VTS. Cutting tools for stitching machines.*	*2*
7	***Processes of retention and transportation of sheet material in the cutting zone and calculation of the vacuum chamber*** *Processes of cutting sheet materials without the use of support elements. Unmarried method of pruning.* *Literature: [3, 4, 5, 6, 7, 9, 14].* *Tasks on VTS. Performance characteristics of cutting tools.*	*2*
	Sheet material alignment and positioning system *Calculation of technical characteristics of the pneumatic chamber. Calculation of the required pressure. Determining the time for keeping and transporting the selected sheet material.* *Literature: [3, 4, 5, 6, 7, 9, 14].* *Tasks on VTS. Technological characteristics of the vacuum chamber.*	

8	***Simulation of the process of air flow in the chamber of the pneumatic marzan of the rotary die-cutting module by means of automated modeling SolidWorks.*** *The geometry of the blade of the cutting tool. Height of the helix, axial pitch and length of the cutting line. Cutting force of curvilinear scan and resistance force. Screw knives of the rotary die-cutting module.* *References: [4, 6, 7, 8, 9, 10, 11, 16].* *Tasks on VTS. Sections for cutting, cutting and cutting sheet material.*	*2*
	Determination of volumetric air flow and its variable temperature *Peak air flow. Dependence of air flow in the area of cutting cardboard scans on its temperature* *References: [4, 6, 7, 8, 9, 10, 11, 16].* *Tasks on VTS. Technological process of cutting in the zone "knife-counter knife".*	
9	***Working contact area of the cutting element and material. The process of crumpling the material.*** *Determination of the contact area between the cutting arc lines and the cutting material. Friction forces. Curvature and deformation of the sheet.* *References: [4, 7, 9, 10, 11, 12].* *Tasks on VTS. Physico-mechanical characteristics of sheet materials.*	*2*
	Total	***18***

6. Independent work of a graduate student

Independent work takes 70% of the time to study the credit module, including preparation for the test. The main task of independent work of graduate students is to master and expand scientific knowledge in areas that are not included in the list of lecture questions by personal search for information, the formation of an active interest in the creative approach in educational work. In the process of independent work within the educational component, the graduate student must learn to deeply analyze modern approaches to the development and implementation of new methods of finding the optimal solution to the tasks.

№ s / n	The name of the topic that is submitted for independent study	Number of hours of VTS
Section 1. Inkjet feeders of sheet materials		
1	*Streaming production of printing and packaging products. INand use of high-performance sections of processing of semi-finished products.* *Literature: [1, 2, 3, 4, 5, 6, 7].* *Automation of processes of giving and loading of sheet semi-finished products in the printing, machine-building, instrument-making, light and other industries.* *Literature: [1, 2, 3, 4, 5].*	15
Section 2. Continuous processing of printing semi-finished products		
2	*Specialized and universal transport and cutting modules. Production lines, insert-sewing-cutting units.* *Literature: [4, 6, 7, 8, 9].* *Devices and elements of the transport system. Use of mechanisms of reversible action.* *Literature: [4, 6, 7, 8, 9].*	16
Section 3. Designs of gripping devices for piece loading of semi-finished products		
3	*Means of loading of polygraphic semi-finished products. Transport and loading mechanisms with high operational reliability and productivity.* *References: [3, 4, 5, 9, 11, 12, 13, 14, 16].* *Static and dynamic characteristics of the capture process of brittle, flexible, non-rigid, coated and other semi-finished products.* *References: [3, 4, 5, 9, 11, 12, 13, 14, 16].*	16
Section 4. Frost-free technologies for cutting sheet materials		
4	*Operating and aggregate cutting sections. Classic methods of trimming printing semi-finished products.* *References: [4, 6, 7, 9, 12, 13, 14].* *Geometry and physical and mechanical characteristics of cutting tools for bookbinding equipment.* *References: [4, 6, 7, 9, 12, 13, 14].*	15
Section 5. Trimming of sheet materials in pneumatic conveying systems		
5	*The use of compressed and rarefied air in the executive units of printing and packaging machines. Productivity of pneumatic sections. Noise and vibration.* *Literature: [3, 4, 5, 6, 7, 9, 14].* *Technological and parametric characteristics of the vacuum chamber. The use of vacuum in the process of cutting materials.* *Literature: [3, 4, 5, 6, 7, 9, 14].*	16

Section. 6. Modeling of air flow processes in pneumatic marzan chambers of the die-cutting module		
6	*Technological loads in sections and devices for cutting, cutting and felling. Equipment for the manufacture of cardboard packaging.* *References: [4, 6, 7, 8, 9, 10, 11, 16].* *Features of the technological process of carving in the zone "knife-counter knife". Qualitative indicators of production of various cardboard packings.* *References: [4, 6, 7, 8, 9, 10, 11, 16].*	*15*
Section 7. Rotary cutting of cardboard scans using pneumatics. Eruption of various holes in cardboard consumer packaging		
7	*Processes of rotary and crucible cutting of cardboard sheet materials. Mechanics of cardboard separation and its physical and mechanical properties.* *References: [4, 7, 9, 10, 11, 12].*	*15*
8	*Preparation for the test*	*6*
	Hours in general	***114***

Policy and control

7. Course policy (educational component)

Rules for attending classes and behavior in class

Attendance is a mandatory component of assessment. Postgraduate 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 be distracted by actions that are not related to the educational process.

Rules for assigning incentive and penalty points

- *Incentive points can be awarded by the teacher only for the performance of creative work in the discipline or additional online profile courses with a certificate;*
- *penalty points within the academic discipline are not provided.*

Policy of deadlines and rearrangements

In the event of arrears of the discipline or any force majeure, graduate students should contact the teacher through available (provided by the teacher) communication channels to resolve problems and agree on an algorithm for practice.

The policy of academic integrity

Plagiarism and other forms of dishonesty are not allowed. Plagiarism includes the lack of links when using printed and electronic materials, citations, opinions of other authors. Inadmissible hints and write-offs when writing tests, conducting classes; passing the test for another graduate student; copying of 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 "Kyiv Polytechnic Institute named after Igor Sikorsky". Read more:https://kpi.ua/code

Policy of academic behavior and ethics

Postgraduate students must be tolerant, respect the opinion of others, formulate objections in the correct form, constructively maintain feedback in the classroom.

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 "Kyiv Polytechnic Institute named after Igor Sikorsky". Read more:https://kpi.ua/code

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

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

Semester	*Training time*		*Distribution of teaching hours*				*Control measures*		
	Loans	*acad. year*	*Lectures*	*Practical*	*Lab. slave.*	*CPC*	*MCR*	*RR*	*Semester control*
4	*5*	*150*	*18*	*18*	*-*	*114*	*-*	*-*	*test*

The rating of a graduate student from the credit module consists of points that he receives for active work in practical classes.

Semester control is a test.

System of rating (weight) points and evaluation criteria

Semester certification is conducted in the form of a test. A 100-point rating system and a university scale are used to assess learning outcomes.

Performing tasks in practical classes.

The weight score for 1 and 2 practical classes is 15 points each; in practical classes 3 - 9 - 10 points.

Criteria for evaluating the implementation of a practical task

Completeness and signs of task performance	***Bali***	
The task is completed in full	*15*	*10*
Minor shortcomings under paragraph 1	*13-14*	*8-9*
Late performance of the task	*10-12*	*7*
Untimely performance of the task, shortcomings under item 1	*2-9*	*2-6*
Poor task performance	*1*	*1*
Failure to complete the task	*0*	*0*

Thus, the rating semester scale of the credit module is:

$$R = 2 \cdot 15 + 7 \cdot 10 = 100 \text{ points}$$

A necessary condition for admission to the test is a rating of at least 40% of the rating scale (R), ie 40 points.

Postgraduate students who scored less than 0.6 R during the semester, as well as those who want to increase the overall rating, perform a test. In this case, all points obtained by them during the semester are canceled. Test tasks contain questions that relate to different sections of the credit module. A list of test questions is attached.

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

Scores	***Rating***
95 ... 100	*perfectly*

85 ... 94	*very good*
75 ... 84	*fine*
65 ... 74	*satisfactorily*
60 ... 64	*enough*
RD < 60	*unsatisfactorily*
Admission conditions are not met	*not allowed*

9. Additional information on the discipline (educational component)

An approximate list of questions that are submitted for semester control

1. Features of work of jet feeders of sheet materials.
2. Jet and vacuum pneumatic elements.
3. Accuracy of base of semi-finished products.
4. Dynamic characteristics of the process of separation and movement of semi-finished products.
5. Continuous processing of printing semi-finished products.
6. Transportation of printing semi-finished products in the area of their processing.
7. Devices of modular structure.
8. The main technological characteristics of the process of transportation of printing semi-finished products.
9. Reversible movement of semi-finished products.
10. Designs of gripping devices for piece loading of semi-finished products.
11. Vacuum-type gripping devices used in industry.
12. Analysis of the use of the design of jet type grippers with a developed end and slot type surface.
13. Methods of analytical calculation of optimal parameters of invaders.
14. Recommendations for the choice of design and technological parameters of jet grippers.
15. Frost-free technologies for cutting sheet materials.
16. Use of an air bag in the working area of the transportation system.
17. Pneumatic conveying system and the principle of its operation.
18. Disk cutting tools of the module for cutting of semi-finished products.
19. Contactless sheet grabber.
20. Pneumatic chamber. Aerodynamic effect.
21. Sheet metal trimming in pneumatic conveying systems.
22. Retention and transportation of sheet material in the cutting area due to the vacuum chamber.
23. Sheet metal alignment and positioning system.
24. Modeling of air flow processes in pneumatic marzan chambers of the die-cutting module.
25. Simulation of the air flow process in the pneumatic marzan chamber of a rotary die-cutting module.
26. Screw knives of the rotary die-cutting module. Height of the helical line, axial pitch and length of the cutting line.
27. Curvilinear division of a cardboard scan.
28. The geometry of the blade of the cutting tool.
29. Cutting force of curvilinear scan and resistance force.
30. Volumetric air flow and its variable temperature.
31. Peak air flow. Dependence of air flow in the area of cutting cardboard scans on its temperature.
32. Rotary cutting of cardboard scans using pneumatics.
33. Eruption of various holes in cardboard consumer packaging.
34. Sheet material and its crumpling.

35. Working contact area between the blades and the material.
36. Change the positioning of the sheet. Displacement phenomena.
37. The area of contact between the cutting arc lines and the cutting material.
38. Friction forces. The process of "stretching" the sheet through the cutting area.
39. Deformation of sheet material.

Work program of the discipline (syllabus):

Compiled:*Prof., Doctor of Technical Sciences, Shevchuk AV and Assoc. Prof., Ph.D. Ivanko AI*

Approved at the meeting of the Department of Machines and Apparatus of Chemical and Oil Refining (Protocol № 26 of 19 June 2021)

Agreed metodic commission of the Faculty of Engineering and Chemistry (Protocol № 11 of June 25, 2021)