

Practice

Educational component work program (Syllabus)

Academic discipline requirements

*Second (Master's)*Level of higher
education

Discipline	13 Mechanical Engineering
Specialty	133 Industrial mechanical engineering
Educational program	OPP Engineering and computer-integrated technologies for designing innovative industry equipment
Status educational component	Required
Form of study	full-time (daytime)/full-time (evening)/correspondence/distance/mixed
Year of training, semester	2nd year, fall semester
Amount educational component	14(420)
Semester control/control measures	test
Class schedule	8 weeks
Language of instruction	Ukrainian
Information about the course leader/teachers	http://intellect.cpsm.kpi.ua/profile/hdg3
Course placement	Sikorsky Platform

Educational component program

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

Students' internships are an integral part of the bachelor's degree training process. Internships are held at modern enterprises and organizations with which cooperation agreements have been concluded.

According to the curriculum of the specialty, pre-diploma (III semester, 8 weeks) internships for students are provided for by the curriculum.

Subject educational component "Practice" – is the study of modern technologies of industrial mechanical engineering, design of machines and devices, devices, technological processes, conducting scientific research, an independent approach to solving engineering problems; study of the labor rationing system, scientifically based and promising areas for increasing the productivity of equipment for the production of chemical, silicate, polymer materials and products; basics of management and marketing, study of the main technical and economic indicators of enterprises of chemical, silicate, polymer materials and products; familiarization with the state of labor protection.

On the basis of internship programs, work programs are developed in accordance with the conditions of internship enterprises.

The work program includes:

- a calendar schedule that displays deadlines;
- processing and obtaining passes at the enterprise;
- completion of safety training with mandatory registration in the company's logbook;

- performance of individual tasks according to the work program;
- report preparation;
- diary design;
- submission of a report, etc.

Goal educational component "Practics"

The purpose of this study educational component formation of a complex of knowledge in the field of modern technologies among masters for the production of chemical, silicate, polymer materials and products, scientific developments of equipment for chemical, polymer and silicate enterprises, a set of skills and abilities necessary for conducting scientific research in this direction. In accordance with the goal, the training of masters in this specialty requires strengthening the competencies formed in students:

- Ability to use information and communication technologies (ZK 01).
- Ability to learn and master modern knowledge (ZK 02).
- Ability to search, process and analyze information from various sources (ZK 03).
- The ability to be critical and self-critical (ZK 04).
- Ability to adapt and act in a new situation (ZK 05).
- Ability to generate new ideas (creativity). (ZK 06)
- Ability to identify, pose and solve problems. (ZK 07)
- Ability to make informed decisions. (ZK 08)
- Ability to work in a team. (ZK 09)
- The ability to create, improve and apply quantitative mathematical, scientific and technical methods and computer software, to apply a systematic approach to solving engineering problems in the field of mechanical engineering, in particular, in conditions of technical uncertainty (SK 01)
- Critical understanding of advanced scientific facts, concepts, theories, principles for the field of mechanical engineering and the ability to apply them to solve complex problems of industrial mechanical engineering and sustainable development (SK 02)
- The ability to create new equipment and technologies in the field of mechanical engineering, to protect intellectual property (SK 03).
- Awareness of the promising tasks of modern production aimed at meeting consumer needs, mastery of trends in innovative development of industry technologies (SK 04)
- Ability to develop and implement plans and projects in the field of industrial mechanical engineering and related activities, to carry out relevant entrepreneurial activities (SK 05).

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

Knowledge:

- Knowledge and understanding of the principles of technological, fundamental and engineering sciences that underlie the branch of mechanical engineering of the relevant industry (PRN 01)
- Knowledge and understanding of mechanics and mechanical engineering and the prospects for their development (PRN 02)
- Know and understand the processes of industrial mechanical engineering, have the skills to use them practically. (PRN 03)
- Knowledge of basic methods of collecting, processing, analyzing and systematizing scientific and technical information about existing equipment and the creation and protection of new intellectual property objects (PRN 08)
- Knowledge of a foreign language for searching, analyzing scientific and technical information, publishing research results, and communicating with specialists (PRN 10).

Skill:

- Perform engineering calculations to solve complex tasks and practical problems in industrial mechanical engineering (PRN 04)

- Analyze engineering objects, processes and methods (PRN 05)
- Find the necessary scientific and technical information in available sources, in particular in a foreign language, analyze and evaluate it (PRN 06)
- Prepare for production and operate equipment and products of industrial mechanical engineering throughout the life cycle (PRN 07)
- Using the fundamental laws of conservation and transfer, select/develop/analyze/implement in CAD systems and other application programs mathematical models and regulations of processes occurring in the workspace and/or in the structures of technological equipment to solve problems of scientific research, design, operation, and modernization of industrial mechanical engineering equipment (PRN 12).

And also additionally:

- Formation of skills for independent work in solving engineering problems in mechanical engineering, deepening theoretical knowledge and practical skills for working in work teams.

- Study of modern technological methods of metalworking and assembly.

- Study of the labor rationing system, scientifically based and promising plans for increasing labor productivity.

- Management and marketing. Study of the main technical and economic indicators of mechanical engineering enterprises.

- Familiarization with the state of labor protection.

- Studying the experience of organizing rationalization and inventive work.

- Obtaining organizational skills in working in a work team while working as a backup for a foreman, designer or technologist.

As a result of the internship, students must:

- know the full range of tasks that are solved in production during the preparation and manufacture of machines and devices, the latest equipment, technology and progressive work methods; methods and means of team management;

- be able to target the team to solve the tasks set, rationally distribute the workload, based on the qualifications and business qualities of the workers; conduct a patent search; develop new technological processes and equipment for their implementation;

- ensure compliance with labor and environmental protection requirements by subordinates;

- acquire skills in organizational work with people and managing large production teams;

- drawing up task plans and schedules of production activities of the brigade, unit, shift, group, sector;

- calculation and analysis of technical and economic indicators of the workshop;

- control of compliance with labor protection requirements;

- design of machines and devices, devices, technological processes, conducting scientific research, independent approach to solving engineering problems.

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

To consolidate and deepen the acquired knowledge in higher education institution (ZVO) knowledge, supplement them with new information on the basis of in-depth analysis and implementation of technological processes, workshop equipment, labor organization, safety techniques, and gain practical experience working on modern procurement, machining, and assembly equipment.

To acquire and strengthen skills in solving design, technological, technical, economic and organizational issues in real production conditions. To become familiar with all types of technical

documentation in detail, the procedure for its development, design and production use. To study issues and systems of product quality management in production.

Based on the data obtained during the internship, students prepare a report of 25-30 pages on sheets of 210*297 mm (A4) format with the assignment of graphic material.

The report must reflect:

- Individual designs and kinematic diagrams of the machine being designed;
- Basic parametric and strength calculations;
- Issues of equipment modernization;
- Individual tasks;
- Calculations that confirm the machine's performance;
- Issues of economics, safety and labor protection when servicing machines.

3. Content educational component

The place of practice is factory workshops where the production of a wide range of plastic and rubber products and parts is established, factory laboratories, design bureaus, departments of the chief mechanic and chief technologist, which are associated with such production.

During the internship, the student must work in the department of the chief technologist (CTO) and in the department of the chief mechanic (CM) or in the design bureau.

Working at VGT, the student must acquire skills in production specialties. Two weeks of compensation are provided for work at VGT. During this time, the student can perform the duties of a backup mechanic or shop technologist, operator, or design technician.

Two weeks of compensation is provided for work at VGM. It is permitted to enroll a student in a full-time position if the work of this position meets the needs of the program.

The student's time balance may be as follows:

1. Organizational activities - issuing passes, safety briefing, distribution to workplaces - 2 days.
2. Work in the department of the chief technologist - 24 days.
3. Work in the chief mechanic's department - 24 days.
4. Preparation of the report and passing the test – 6 days.

Total - 56 days (8 weeks).

Patent developments and technical information on the topic of the diploma project.

Technical documentation for the project according to the requirements of the ESKD and standards.

Issues of improving working conditions, safety, automation, aesthetic appearance, minimum machine weight and ease of repair, etc. Calculation and explanatory note for a typical basic machine.

Justification of its choice, direction of modernization of its processes. Description of the design and principle of operation of the machine. Complementary equipment.

Parametric calculations of machines (power, geometry, kinematics, etc.), calculations for the strength of key components and parts.

Thermal calculations (machine heating, cooling devices).

Clarification of the technological operating mode of the designed machine and the line as a whole (temperature, rotation frequency, speed, pressure, etc.).

Unification and standardization of prefabricated units.

Nomenclature of technological documentation for the project. Main documents of the ESTD. Stage of manufacturing machines in the workshop, assembly of machines, adjustment, verification tests of work in the line.

Devices for mechanical processing of parts. Assembly of main components. Measures to maintain the operability of machines.

Costs of manufacturing the machine. Material intensity of construction. Labor intensity of construction. Wages. Indirect overhead costs. Installation costs, transportation costs, cost of business premises. Operating costs. Energy. Repairs. Depreciation of workshops and general workshop costs.

4. Educational materials and resources

Basic literature

1. Technology of production of materials and products for construction purposes. Textbook [Electronic resource]: a textbook for bachelor's degree applicants in the educational program "Engineering and computer-integrated technologies for designing innovative industry equipment" specialty 133 "Industrial mechanical engineering" / Igor Sikorsky Kyiv Polytechnic Institute; compilers: V. Yu. Shcherbina, D. G. Shvachko, L. N. Gur'eva. - Electronic text data (1 file: 16.56 MB). - Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2024. - 188 p. - Title from the screen. **URI**<https://ela.kpi.ua/handle/123456789/66516>
2. Hydraulic presses. Press equipment [Electronic resource]: training manual for bachelor's degree applicants in the educational program "Packaging and packaging equipment engineering", "Engineering and computer-integrated technologies for designing innovative industry equipment" spec. 131 "Applied mechanics", 133 "Industrial mechanical engineering" / Igor Sikorsky Kyiv Polytechnic Institute; compilers: V. I. Sivetsky, D. G. Shvachko. – Electronic text data (1 file: 4.12 MB). – Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2023. – 147 p. – Screen title.<https://ela.kpi.ua/handle/123456789/62813> (under review)
3. Equipment for casting, pneumatic-vacuum forming [Electronic resource]: a teaching aid for bachelor's degree applicants in speciality 131 "Applied mechanics", 133 "Industrial mechanical engineering" / Igor Sikorsky Kyiv Polytechnic Institute; compiled by: V. I. Sivetsky, D. G. Shvachko. – Electronic text data (1 file: 4.5 MB). – Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2023. – 140 p. – Screen title. <https://ela.kpi.ua/handle/123456789/62812> (under review)
4. Rolling machines. [Electronic resource]: training manual for bachelor's degree applicants in the educational program "Packaging and packaging equipment engineering", "Engineering and computer-integrated technologies for designing innovative industry equipment" speciality 131 "Applied mechanics", 133 "Industrial mechanical engineering" / Igor Sikorsky Kyiv Polytechnic Institute; compilers: Sivetsky V.I., Sidorov D.E., Shvachko D.G. – Electronic text data (1 file: 4.12 MB). – Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2023. – 120 p. – Screen title. <https://ela.kpi.ua/handle/123456789/62811>
5. AutoLISP in the design of technological equipment [Electronic resource]: a textbook for students of the master's degree in the educational and scientific program "Engineering and computer-integrated technologies for the design of innovative industry equipment", specialty 133 "Industrial mechanical engineering" and the program "Engineering of packaging and packaging equipment", specialty 131 "Applied mechanics" / V. Yu. Shcherbina, O. V. Gondlyakh, A. O. Chemerys, D. G. Shvachko ; Igor Sikorsky Kyiv Polytechnic Institute. - Electronic text data (1 file:). - Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2024. - 175 p. - Title from the screen. **URI**<https://ela.kpi.ua/handle/123456789/67865>

Information resources on the Internet

1. <https://studfile.net/preview/5532354/page:4/>
2. <http://ep3.nuwm.edu.ua/4741/1/V55.pdf>
3. <http://bibliograph.com.ua/spravochnik-33/36.htm>

4. <https://studfile.net/preview/5241906/page:14/>
5. https://studopedia.su/9_43580_materlali-l-virobi-z-mIneralnih-rozplavlv.html
6. <http://um.co.ua/8/8-8/8-80177.html>
7. <https://studfile.net/preview/5241906/page:27/>
8. <http://bibliograph.com.ua/spravochnik-76/>
9. The working program of the credit module (syllabus) is in the "Campus" system, on the "Sikorsky" platform and on the website of the department (faculty);
10. Tutorials:
<https://ela.kpi.ua/items/b2b108f6-cc47-40d4-9cf4-f40af6b650fe>
<https://ela.kpi.ua/handle/123456789/62811>

Educational content

1. Methodology for mastering the educational component

Materials used for designing parts of chemical engineering. Kinematic diagrams of mechanisms and machines. Calculations of components and parts using CAD. Drawing up a passport of a typical machine and its kinematic diagram, detailed description, structure and operation of the machine, specification of links, characteristic pairs and parts that are manufactured in series (bearings, gears, etc.), materials, modules, number of teeth, standard numbers, names of main parts, their mass and dimensions, lubrication map and diagram, calculation of lubricant consumption. Design of bearing housings, worms and worm wheels, cylindrical and bevel gears, risers, bearings, shafts, working parts of the machine. Design of the simplest components: reducers, assembly rolls, worms with a cylinder, rotors, etc. Designs of machines for processing silicate, polymer materials and other chemical raw materials. Technological processes for the production of machines for flexible technologies. Structure and organization of the design bureau. Stages of machine design. Tasks of the designer. Techniques in work, sequence of machine design. Layout of components and the machine as a whole. Drawing up a calculation and explanatory note. Physico-chemical and structural properties of materials used for the manufacture of machines. Methods of calculating the strength of machines adopted at this enterprise.

Tool production technology. Metal cutting technology. Heat treatment of parts. Assembly work. Assembly of lever mechanisms, connecting rods, couplings, reducers, mixers, rollers, colanders, etc. Devices for stamping. Post-assembly testing. Technical and economic indicators of the machine assembly process.

5.1 Occupational health and safety

Before completing the internship, students must: study the organization of the labor protection service at the enterprise; know the basic safety measures during the operation, repair and installation of equipment in order to develop these issues when designing machines and devices and undergo a briefing on safety techniques in the workplace.

5.2 Individual tasks

The individual task is the design of parts and assembly units, their calculations, including using computers in relation to the enterprise. The topic of the tasks corresponds to the curriculum of the main master's courses.

Approximate topics of individual tasks:

1. Grafted crusher with complex cheek swing
2. Grafted crusher with simple cheek swing
3. Coarse grinding cone crusher
4. Medium Grinding Cone Crusher

5. *Hammer crusher*
6. *Roller crusher*
7. *Wet grinding runners*
8. *Dry grinding runners*
9. *Pendulum mill*
10. *Pipe mill*
11. *Electrostatic precipitator*
12. *Single chamber ball mill*
13. *Inertial grate screen*
14. *Eccentric vibrating screen*
15. *Bag filter*
16. *Double chamber ball mill*
17. *Drum dryer*
18. *Bag filter*
19. *Drum filter*
20. *Filter press*
21. *Shell and tube heat exchangers.*
22. *Reactors.*
23. *Drum dryer.*
24. *Belt dryer.*
25. *Recirculating dryer.*
26. *Cooling bath.*
27. *Air cooling device.*
28. *Calibrating nozzles.*
29. *Tunnel furnace.*
30. *Worm machine.*
31. *Casting machine.*
32. *Blow molding machine.*
33. *Vacuum forming machine.*
34. *Formator-vulcanizer.*
35. *Hydraulic press.*
36. *Waltz.*
37. *Rotary mixer.*
38. *Disc mixer.*
39. *Two-stage mixer.*
40. *Pneumatic loader.*
41. *Rotary shredder.*
42. *Lines for the production of sheets, pipes, films and other thermoplastic products*

5.3 Lectures, discussions and excursions during practice

In practice, students must attend lectures organized by practice supervisors from the enterprise.

Recommended lectures and talks:

1. *History of the enterprise, its structure, organization and development prospects.*
2. *New materials for making machines and the latest achievements in the field of mechanical engineering.*
3. *Design procedure and stages.*
4. *Issues of production economics.*

Excursions are held to the departments and laboratories of the enterprise, and other enterprises of industry specialization.

Policy and control

2. Educational component policy

Rules for class attendance and behavior in class

Students undergo internships in design bureaus of enterprises and institutions.

Approximate time balance:

1. Organizational activities - issuing passes, safety briefing, distribution to workplaces - 2 days.
2. Work in the department of the chief technologist - 24 days.
3. Work in the chief mechanic's department - 24 days.
4. Preparation of the report and passing the test – 6 days.

Total - 56 days (8 weeks).

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.port.ac.uk/study/courses/beng-hons-innovation-engineering>;
 - Other courses may be credited upon agreement with the instructor.
- Penalty points are not provided within the framework of the academic discipline.

Deadline and Rescheduling Policy

In the event of academic discipline arrears or any force majeure circumstances, students should contact the teacher via available (provided by the teacher) communication channels to resolve problematic issues and agree on an algorithm of actions for completion.

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>

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

Distribution of study time by types of classes and tasks with educational component:

Semester	Study time		Distribution of teaching hours				Control measures		
	Loans	academic year	Lectures	Practical (seminar)	Lab work	CRC	MKR	abstract	Semester control
3	14	420	-	-	-	420	-	-	test

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

A student's rating for the educational component consists of the points he receives for his work in practice.

The semester test is a credit.

Rating (weighting) points system and evaluation criteria

The internship rating R has two components. The first (starting R_c) characterizes the student's internship work and its result - the quality of the explanatory note, thesis, and graphic material. The second component R_z characterizes the quality of the student's defense of the internship report.

The scale size of the starting component R_c is 50 points, and the protection component R_z is –50 points.

7.1 Starting component R_c :

- Timeliness of implementation of the internship schedule – 16-5 points;
- modernity and justification of decisions made – 10-5 points;
- correct application of analysis and calculation methods – 8-4 points;
- quality of design, fulfillment of requirements of regulatory documents (report, abstracts) – 8-4 points;
- quality of graphic material and compliance with standards – 8-4 points.

7.2 Component of the R -protection from the internship report:

- quality of the report with presentation – 12-6 points;
- degree of mastery of the material – 12-5 points;
- the degree of justification of the decisions made – 12-5 points;
- ability to defend one's opinion – 12-2 points.

The rating of the maximum points of a student R in practice consists of two components: $R = R_c + R_z = 50 + 50 = 100$ points. If $R < 60$ points, then the student is not allowed to defend the practice.

7.3 The sum of the scores of the two components is converted into a credit score according to the rating scores 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
$R < 60$	unsatisfactorily
Admission conditions not met	not allowed

4. Additional information on the educational component

Approximate list of questions that will be assessed

1. Provide a structural diagram and describe the principle of operation of an autoclave press.
2. What is the purpose of a pre-graduate internship?
3. Provide a structural diagram and describe the principle of operation of the side formation mechanism.
4. What is the subject of study of the educational component "Practice"?
5. Provide a structural diagram and describe the principle of operation of the unloading device of a rotary mixer.
6. What materials are used in the manufacture of packaging equipment elements?

7. *Provide a structural diagram and describe the principle of operation of the cooling device for the mixer rotors.*
8. *What types of packaging equipment did you learn during your internship?*
9. *What forms of patent search did you use during your practice?*
10. *Characterize the design of a simple cheek-swinging graft.*
11. *Provide a kinematic diagram of the blade mixer drive.*
12. *What technical and economic indicators of the enterprise did you analyze?*
13. *Describe the essence and list the varieties of pneumatic vacuum forming methods.*
14. *What are parametric equipment calculations?*
15. *Describe the layout diagrams of a blow molding machine.*
16. *How is the drive power of packaging equipment calculated?*
17. *Describe the essence and list the varieties of pneumatic vacuum forming methods.*
18. *What are the main components of a packaging machine can you name?*
19. *What is the role of a backup designer or technologist at an enterprise?*
20. *Describe the design of a coarse cone crusher.*
21. *Provide a kinematic diagram of the rotary mixer drive.*
22. *What indicators are taken into account when checking the performance of a machine?*
23. *Purpose and functions of the head for extrusion blow molding.*
24. *What software can be used to design machines?*
25. *Provide a structural diagram and describe the principle of operation of the unloading device of a rotary mixer.*
26. *Name the basic principles of technological equipment modernization.*
27. *Describe the principle of operation and the cycle diagram of operation. Performance of a rotary mixer.*
28. *How is the strength of machine parts calculated?*
29. *What production tasks did you perform during your internship?*
30. *Describe the design of a hammer mill.*
31. *What are the features of the work organization in the chief mechanic's department?*
32. *Describe the design of a cone crusher. Medium-sized cone crusher.*
33. *What did the internship give you in terms of your future professional activities?*
34. *Where is it used? chip crushers with complex cheek swing.*
35. *Provide a diagram of the principle of operation of a "Beg-o-matic" type former-vulcanizer and describe it.*
36. *What documents must a student fill out during an internship?*
37. *Provide a structural diagram and describe the principle of operation of a tire assembly machine.*
38. *What competencies should be formed as a result of internship?*
39. *Describe the sequence of calculating the parameters of the machine and pneumatic-vacuum systems.*
40. *Provide a kinematic diagram of the blade mixer drive.*
41. *Provide a structural diagram and describe the principle of operation of an oscillating mixer.*
42. *What is the structure of an internship report?*
43. *Provide a structural diagram and describe the principle of operation of double-worm thrust bearing assemblies. barley mixer.*
44. *Which departments of the company are most often involved in internships?*
45. *Provide a diagram of the principle of operation of an autoform type former-vulcanizer.*

46. and describe it. Provide a structural diagram and describe the principle of operation of a dipteran barley mixer.
47. What is a practice diary and how to fill it out?
48. Provide a structural diagram and describe the principle of operation of an "autoform" type former-vulcanizer.
49. Where can students do their internship according to the program?
50. Provide a structural diagram and describe the principle of operation of an individual vulcanizer.
51. What are the main tasks facing a student during internship?

Work program educational component (syllabus):

Compiled assistant, Shvachko D.G.

Approved by the department ____KhPSM____ (minutes No. 17 dated 04.06.2025)

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