

Research practice

Educational component work program (Syllabus)

Academic discipline requirements

Level of higher education	<i>Second (Master's)</i>
Discipline	<i>13Mechanical Engineering</i>
Specialty	<i>131Applied mechanics</i>
Educational program	<i>ONP Packaging and Packaging Equipment Engineering</i>
Statuseducational component	<i>Required</i>
Form of study	<i>full-time (daytime)/full-time (evening)/correspondence/distance/mixed</i>
Year of training, semester	<i>2nd year, spring semester</i>
Amounteducational component	<i>12(360)</i>
Semester control/control measures	<i>test</i>
Class schedule	<i>6 weeks</i>
Language of instruction	<i>Ukrainian</i>
Information about the course leader/teachers	<i>http://intellect.cpsm.kpi.ua/profile/hdg3</i>
Course placement	<i>Sikorsky Platform</i>

Academic discipline program

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

Students' internship is an integral part of the process of graduate training of masters in specialty 131 Applied Mechanics, specialization Engineering of Packaging and Packaging Equipment. Internship takes place on the basis of modern enterprises and organizations with which cooperation agreements have been concluded.

According to the curriculum of the specialty, it is planned to conduct research (IV semester, 5 weeks) practice for students provided for by the curriculum.

Subject of the educational component "Scientific and research 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 standardization 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;
- passing a safety training course with mandatory registration in the company's logbook;

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

Goal educational component "Research Practice"

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

- *Ability to identify, pose and solve engineering, technical and scientific problems (ZK 01);*
- *Ability to communicate with representatives of other professional groups at different levels (with experts from other fields of knowledge/types of economic activity) (ZK 05);*
- *Ability to learn and master modern knowledge (ZK 06);*
- *The ability to clearly and unambiguously convey one's own conclusions, knowledge, and explanations to specialists and non-specialists, including in the process of teaching (FC 04);*
- *Ability to plan and carry out experimental and theoretical research in applied mechanics and related interdisciplinary problems, to process and summarize research results (FC 05).*

*1.2. According to the requirements of the training program educational component «**Research practice**», after mastering it, students must demonstrate the following program learning outcomes:*

- *Apply automation systems to perform research, design work, technological preparation and engineering analysis in mechanical engineering (PRN 03);*
- *Independently set and solve innovative problems, argue and defend the results obtained and decisions made (PRN 05);*
- *Clearly and unambiguously present the results of research and projects, convey one's own conclusions, arguments and explanations in the state and foreign languages, orally and in writing, to colleagues, education seekers and representatives of other professional groups of various levels. PRN 07*
- *Learn and master modern knowledge, technologies, tools and methods, in particular through independent study of professional literature, participation in scientific, technical and educational events (PRN 08);*
- *Organize the work of a group when performing tasks, complex projects, scientific research, understand the work of others, give clear instructions (PRN 09);*
- *Search for necessary information in scientific and technical literature, electronic databases and other sources, assimilate, evaluate and analyze this information (PRN 10);*
- *Plan and carry out experimental and theoretical research in the field of applied mechanics, analyze their results, and justify conclusions (PRN 11);*
- *Provide engineering information support for the product at all stages of its operation (PRN 13);*
- *Plan and carry out experimental and theoretical research in the field of applied mechanics, analyze their results, and justify conclusions (PRN 15);*
- *Optimize technical solutions at the design and operation stage of products and equipment using modern calculation algorithms and specialized software packages (PRN16).*

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.*

2. *Study of modern technological methods of metalworking and assembly.*
3. *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.*
 - *Study of 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.*

4. *Prerequisites and postrequisites of the discipline (place in the structural and logical scheme of study according to the relevant educational program)*

The practice consists of the following stages: studying the structure of the enterprise, laboratory, department, the organization of production and scientific research activities in them; studying the range of production, scientific research tasks, the solution of which the unit is working on; studying the essence of the individual task set by the manager, studying its place and significance in the general structure of the unit's tasks; information support for the task, work on the relevant scientific and technical literature, regulatory documents, their analysis; obtaining specific results from the development of an individual task (research, dependencies, drawings, calculations, modeling, computer programs) and their analysis; evaluating the results obtained from the point of view of their implementation in production, writing a scientific publication and the possibility of their use in the further performance of the master's thesis; choosing and substantiating the topic of the master's thesis.

Conducting scientific research, selecting material for a master's thesis. Determining its sufficiency and reliability.

Requirements for conducting scientific research. Sequence of conducting scientific research. Experiment as an integral part of scientific research. The role of the scientist's personality in conducting research.

General information about information. Typology of scientific information and main types of publications. Features of secondary information and its search. How to work with literature correctly.

Invention and development of scientific creativity. Discoveries and inventions. Positive effect of inventions. Formula of invention. Description of inventions. Rationalization proposals.

Forms of summarizing the results of scientific research. Methods of summarizing and processing the results of experimental research. Methods of summarizing and processing the results of experimental

research. Requirements for the design of scientific papers. Familiarization with the plan of the specialized department and the teaching staff.

Drawing up an individual plan for completing scientific and pedagogical practice.

Familiarization with the main areas of work of the specialized department, as well as with educational and methodological literature, scientific research and organizational and educational work of teachers.

Attending lectures, laboratory and practical classes conducted by the department's teachers.

Familiarization with the methodological literature and research and laboratory base of the specialized department.

Preparation of abstracts for a report for a student conference and articles on the topic of a master's thesis for publication in a scientific collection.

Drawing up a plan-synopsis of one lesson in a professionally oriented or special discipline of a specialized department.

Preparing for the lesson.

Conducting one lesson in the chosen discipline (in front of an audience of students with the invitation of other master's students from the same department, practice supervisors from the department, as well as supervisors of their master's theses) and its psychological and pedagogical analysis.

Analysis and systematization of the information received and one's own experience (reflected in the diary of scientific and pedagogical practice).

Formulation of the research goal and objectives for the master's thesis.

Preparation of a report on scientific and pedagogical practice.

3. Contents 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 - 14 days.*
- 3. Work in the chief mechanic's department - 14 days.*
- 4. Preparation of the report and passing the test - 5 days.*

Total - 35 days (5 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)
- 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>

Additional literature

1. Gavva O.M., Bepalko A.P. Packaging equipment. - Kyiv: Upakovka, 2008.

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-i-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) - in the "Campus" system, on the "Sikorsky" platform and on the website of the department (faculty);

10. Tutorials:

Educational content

5.Mastering methodology educational component

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

- to familiarize yourself with the main areas of work of the scientific and pedagogical team of the department, the work plan of the department;

- familiarize yourself with the documentation that reflects the content of professional training and requirements for future graduates (bachelors, specialists, masters): OKH, OPP, curricula;

- get acquainted with the scientific works of the department's teachers and methodological recommendations, the laboratory base of the specialized department;

- attend several classes of the department's teachers;

- draw up a plan-synopsis of one (lecture, laboratory or practical) lesson in a professionally oriented or special discipline of the specialized department, while coordinating the chosen discipline and topic with the scientific supervisor of the master's thesis;

- conduct one lesson in the chosen discipline;

- to study and master the basic principles and approaches to patent search for analogues of technical solutions in the chosen scientific direction;

- write a scientific article and prepare a report on the topic of the master's thesis and the results of the patent search.

As a result of studying the course, students should:

1. Understand the essence of such theoretical concepts as educational project, project method, research activity, creative activity, educational problem, pedagogical technologies, project portfolio.

2. Know the characteristics and purpose of the key and thematic questions of the educational project.

3. Be able to develop a plan for an educational project.

4. Be able to define learning goals and expected learning outcomes.

5. Know the basic provisions of the Copyright Law.

6. Know the measures to protect copyright for electronic publications.

7. Be able to search for information resources for an educational project.

8. Be able to create a list of information sources.

9. Search for information resources on the Internet.

10. Be able to use email.

11. Be able to create a multimedia presentation.

5.1 Occupational health and safety

Creation of safe working conditions, environmental protection and rational use of natural resources. Characteristics of hazards and fire safety of production. Organization of labor protection service in the laboratory, in the department and at the enterprise as a whole. Basic safety instructions. Main industrial hazards (vibrations, gas pollution, dust, noise, etc.), standards, control over the state of the production environment. Causes of injuries and occupational diseases of workers.

5.2 Individual tasks

Each student performs an individual task in production practice. The student writes down the topic and specification of the task in a diary. The topic of the task is a more in-depth study of a specific machine or device, technological operation or design development in chemical engineering with the introduction of elements of novelty, modernization and automation.

The individual task during the research internship is to develop the main questions related to the topic of the master's thesis, which the student receives at the beginning of the internship from the supervisor.

During the period of research practice, the student studies patent developments in the Department of Scientific and Technical Information and the Library over the past two years and outlines ways of modernization in his master's thesis.

5.3 Lectures during practice

In order to closely link students' studies at higher education institutions with the work of industrial enterprises, and to accumulate knowledge about the current state and level of advanced domestic industries during internships, theoretical classes are planned to be held by qualified specialists (economists, technologists, rationalizers and inventors, scientists).

It is recommended that theoretical classes be held for at least four hours per month in the form of lectures, consultations, and interviews.

In addition, the student must participate in scientific and technical conferences or seminars held during the internship at the enterprise.

The practice manager from the university conducts methodological classes and consultations.

Theoretical training is carried out in accordance with the master's curriculum.

Approximate list of theoretical classes:

- 1. Pedagogy and psychology of higher education*
- 2. Methodology of teaching general technical subjects in higher education*
- 3. Occupational safety in educational institutions*
- 4. Computer-aided design systems*
- 5. Fundamentals of scientific research*
- 6. Current status and prospects for the development of chemical equipment*
- 7. Methods of teaching computer science and mathematics in higher education*
- 8. Information and communication technologies*
- 9. Higher education and the Bologna Process*
- 10. Intellectual property*

Policy and control

6. Policy educational component

Rules for class attendance and behavior in class

Students undergo internships in design bureaus of enterprises and institutions.

Approximate time balance:

- 1. Organizational activities, safety briefing and introduction to the enterprise - 2 days.*
 - 2. Familiarization with the equipment of the enterprise, the student's main workplace, visits to workshops, departments and laboratories - 7 days.*
 - 3. Completion of an individual task (work at the workplace) - 21 days.*
 - 4. Preparation of the report and preparation of the practical assessment - 5 days.*
- Total - 35 days*

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

5. 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
4	12	360	-	-	-	360	-	-	test

A student's rating for 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.

Semester control test.

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 work schedule for research practice – 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 defense of the R-report on research practice:

- 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 research practice consists of two components:
 $R = R_c + R_3 = 50 + 50 = 100$ points. If $R < 60$ points, 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

6. Additional information on the educational component

Approximate list of questions that will be assessed

1. How to assess the possibility of implementing research results into production?
2. The purpose and objectives of scientific research practice.
3. What are the requirements for a research internship report?
4. The main stages of completing research practice.
5. What are the features of working in the chief mechanic's department during internship?
6. How can a student use the results of the internship in his master's thesis?
7. In what cases can a student be hired for a full-time position during their internship?
8. What are the main requirements of the ECCD for technical documentation?
9. Principles of analyzing the effectiveness of research results.
10. What competencies are formed during internship?
11. How is the choice of a master's thesis topic justified based on practice?
12. What is an independent approach to solving engineering problems?
13. How do you prepare for a speech at a scientific conference?
14. The procedure for preparing a scientific article for publication.
15. How are the results of scientific research formalized?
16. The concept of rationalization proposals: role in practice.
17. Promising directions for increasing labor productivity.
18. How are modern CAD and engineering programs used during research?
19. How to determine the reliability of the results of a scientific study?
20. What methods of optimizing technical solutions do you know?
21. How are the project's technical and economic indicators calculated?
22. In what cases is it advisable to use modeling in machine design?
23. In what cases can a student be hired for a full-time position during their internship?
24. What are the main requirements of the ECCD for technical documentation?
25. What are the features of working in the chief mechanic's department during internship?
26. How can a student use the results of the internship in his master's thesis?
27. Application of automated systems in the production of packaging equipment.
28. Principles of modeling technological processes.
29. How is a claim formulated?

30. What is the importance of experience in inventive and rationalizing activities for a master's degree?
31. Fundamentals of management and marketing at machine-building enterprises.
32. Methodology for evaluating the technical and economic indicators of an enterprise.
33. What are the features of organizational work in production teams?
34. What does an individual assignment for the internship period include?
35. Safety and health requirements during research.
36. How is a patent search conducted on the topic of a master's thesis?
37. Standardization and unification of machine components.
38. What are the features of conducting a scientific experiment?
39. Thermal calculations and their importance in the design process.
40. Principles of planning and organizing scientific research.
41. Calculations for the strength of the main equipment components.
42. Structure of an engineering report based on the results of practice.
43. What parameters are taken into account when upgrading equipment?
44. Requirements for a practice diary: how to properly design it?
45. Tasks performed by a stand-in for a designer or technologist.
46. Types of scientific information and features of its processing.
47. Features of work in the department of the chief technologist.
48. Methods of searching and analyzing scientific and technical information.
49. What sections does the project explanatory note include?
50. Fundamentals of labor rationing in mechanical engineering.

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)