



IGOR SIKORSKY KYIV
POLYTECHNIC
INSTITUTE



Chemical, polymeric and
silicate engineering
department

Innovative practice of engineering
Working program of the educational component (Syllabus)

Details of the educational component

**Level of higher
education**

The third (educational and scientific)

Branch of knowledge	<i>13 Mechanical engineering</i>
Speciality	<i>131 Applied Mechanics</i>
Educational program	<i>Applied Mechanics</i>
Status of educational component	<i>Selective</i>
Form of training	<i>full-time(day)</i>
Year of preparation, semester	<i>2nd year, 3 semester</i>
Volume of educational component	<i>5 /150 h (56 aud. 94 ind.)</i>
Semester control/ control measures	<i>Exam</i>
Schedule of classes	<i>4 hours per week (2 hour of lecture and 2 hours of practices)</i>
Language of instruction	<i>Ukrainian</i>
Information about course leader / teachers	<i>http://intellect.cpsm.kpi.ua/profile/sde9</i>
Course placement	<i>Sikorsky Platform</i>

Program of educational component

1. Description of the Educational component, its purpose, subject of study and learning results

Innovative activity is, along with scientific activity, the main task of a highly qualified specialist. Innovative practice is work on the development of new systems, equipment, processes, projects, programs that characterize their focus on development and include actually implemented innovations.

To a large extent, the solution to the innovation problem will be determined by the level of training of specialists working in a certain industry. Therefore, for the successful solution of this problem, the combination of professional training and knowledge in the field of methodology of innovation processes will be decisive.

Educational component "Innovative practice of engineering" - implementation of approaches to one's own innovation activity, innovation activity of the enterprise.

The purpose of the educational component "Innovative engineering practice"

- *- The ability to critically analyze, evaluate and synthesize new and complex ideas in the process of researching mechanical structures, machines, materials and production processes of mechanical engineering based on the latest knowledge in the field of mechanics and related subject areas (FC 01);*
- *- The ability to generate new ideas and the ability to substantiate new innovative projects and promote them on the market (FC 03);*
- *- The ability to critically understand problems in education, professional and research activities at the level of the latest achievements of engineering sciences and at the border of subject areas (FC 04);*
- *- The ability to plan and carry out experimental research, process the results of the experiment based on the use of modern information technologies and microprocessor technology, interpret the results of full-scale or model experiments (FC 06).*
- *The educational component "Innovative Practice of Engineering" helps the postgraduate student demonstrate the following program learning outcomes:*
- *- Know the general theory and methods of conducting scientific research and be able to practically apply them for research of objects in the field of mechanical engineering (PRN 01);*
- *Perform scientific research and, based on the analysis of its results, determine ways to solve the tasks set (PRN 02).*

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

The study of the educational component "Innovative practice of engineering" as a discipline is based on the principles of integration of various knowledge obtained by graduate students during bachelor's and master's degrees when studying general and engineering-technical disciplines. General knowledge of economics and engineering educational components is welcome. The educational component refers to the cycle of optional educational components. Strengthens the competence of the educational components of the normative part of the educational and scientific program.

3. Contents of the educational component

What is engineering. Emergence of the concept and types of engineering. Development of international engineering. World trends in engineering. Domestic realities.

Innovations. Content and stages of innovation processes. Technical, organizational, informational, social, economic innovations. Stages of the innovation process. Life cycle of machine-building products.

Research works. Product design. Research and development works.

Product phase and life cycle. Factors of forming an adequate understanding of the customer's needs. Stakeholders.

Dynamics, forecasting and modeling, technology capabilities, personnel.

Choosing the direction of innovation. Strategy and choice of path of innovative activity.

Planning of innovative activities of the enterprise. Approaches, principles, components, services of the enterprise.

Innovative policy of the enterprise and sustainable development of the enterprise. Some issues of Internet technologies.

Subversive innovations. Disruptive innovations.

Technological innovation. Example: reducing the duration of the production cycle. New product design.

Principles of evaluation of innovative projects. Theory of innovation processes. Risk of failure.

3. Training materials and resources

Basic literature

1. Іноваційна практика інжинірингу : навч. посіб. для студ. спеціальності 133 Галузеве машинобудування, 131 Прикладна механіка, 101 Екологія / КПП ім. Ігоря Сікорського ; уклад. Д. Е. Сідоров. – Київ : КПП ім. Ігоря Сікорського, 2021. – 82 с.
<https://ela.kpi.ua/handle/123456789/42286>
2. Єселевський С.Лун. 24, 2017. Про науку, інновації та велику різницю між ними.
<https://innovationhouse.org.ua/columns/o-nauke-ynnovatsyyah-y-bolshoj-raznytse-mezhdu-nymy-2/>
1. Тугай О.А., Власенко Т.В. Загальні основи інжинірингової діяльності та її сучасний стан в Україні. // Нові технології в будівництві. № 34. 2018.
http://ntinbuilding.ndibv.org.ua/archive/2018/34_2018/5.pdf
2. Кондратюк А.А. Розвиток міжнародного інжинірингу: світові тенденції та вітчизняні реалії / А.А. Кондратюк, І.М. Манаєнко. // Збірник наукових праць молодих учених ФММ НТУУ "КПІ ім. Ігоря Сікорського". – 2017. – № 11.
3. Кузьмін О.Є. Іноземний досвід інжинірингової діяльності / О.Є. Кузьмін, В.Й., Жежуха, Н.А. Городиська // Проблеми економіки. – 2014. – №3. – С. 240 – 245.
4. Вимоги Matchtech Engineering Recruitment Specialists до фахівця.
<https://www.matchtech.com/job/EMP404273/innovation-engineer--product-development-havant-england>
5. Ikhlq Sidhu. Innovation Engineering: Principles and Methodology. May 22, 2019.
<https://scet.berkeley.edu/innovation-engineering-principles-and-methodology/>.
6. Technological innovations and practices in engineering education: a review. Marcela Hernandez-de-Menendez&Ruben Morales-Menendez. International Journal on Interactive Design and Manufacturing (IJIDeM) volume 13, pages713–728(2019).

Additional literature

7. Engineering News Record [Електронний ресурс].
http://www.enr.com/toplists/2015_Top_225_International_Design_Firms1.
8. Мясников В. Фіктивну модернізацію зупинять інжинірингові компанії / В. Мясников // Незалежна газета. – 2013. – №7. – С.26 – 32.
9. Румянцев А.П. Світовий ринок послуг: [навч. посіб.] / А.П. Румянцев, Ю.О.Коваленко. – К: Центр навчальної літератури, 2006. – 456 с.
10. Ярошук А.О. Україна в міжнародному обміні інженерно-технічними послугами / А.О.Ярошук // Управління економічними процесами у світовій та національній економіці: зб. тез наук. робіт. – К.: Аналітичний центр «Нова Економіка», 2015. – 144 с.
11. Денисенко М.П., Михайлова Л.І., Грищенко І.М., Гречан А.П. та ін. Інвестиційно-інноваційна діяльність: теорія, практика, досвід. / Денисенко М.П. – Суми: ТОВ «ВТД «Університетська книга», 2008. – 1050 с.

Information resources on the Internet

1. <https://www.spiedigitallibrary.org/conference-proceedings-of-spie/10452/1045240/To-promote-the-engineering-innovative-abilities-of-undergraduates-by-taking/10.1117/12.2266119.full?SSO=1>
2. <https://genderedinnovations.stanford.edu/methods/innovation.html>
3. <https://www.sciencedirect.com/science/article/pii/B9780123973108000038>
4. https://www.researchgate.net/publication/293313054_Innovation_Engineering_The_Skills_Engineers_Need_to_be_Innovative
5. <https://link.springer.com/article/10.1007/s12008-019-00550-1>
6. <https://www.asme.org/topics-resources/content/10-innovative-engineering-institutes>
7. Міністерство захисту довкілля та природних ресурсів України - <https://mepr.gov.ua/>
8. Промислова екологія. Спільнота фахівців-екологів - <http://www.eco.com.ua/>
9. Професійна Асоціація Екологів України (ПАЕУ) - <https://paeu.com.ua/>

Educational content

5. Methods of mastering the educational component

Lecture classes

Lectures are aimed at:

- provision of modern, integral, interdependent knowledge in the educational component "Innovative engineering practice", the level of which is determined by the target attitude to each specific topic;
- ensuring creative work of post-graduate students together with the teacher during the lecture;
- education of postgraduate students' professional and business qualities and development of their independent creative thinking;
- forming the necessary interest in graduate students and providing direction for independent work;
- definition at the current level of the development of science in the field of modern methods, processes, forecasting the development of the industry for the coming years;
- reflection of the methodical processing of the material (highlighting of the main provisions, conclusions, recommendations, clear and adequate to their wording);
- the use of visual materials for demonstration, combining them, if possible, with the demonstration of results and samples;
- teaching research materials in clear and high-quality language with observance of structural and logical connections, clarification of all newly introduced terms and concepts;
- accessibility for perception by this audience.

Practical (seminar) classes

In the system of professional training of graduate students in this educational component, practical classes occupy 50% of the classroom load. As a supplement to the lecture course, they lay and form the basis of the qualification of the doctor of philosophy. The content of these classes and the method of conducting them should ensure the development of the creative activity of the individual. They develop scientific thinking and the ability to use special terminology, allow you to test your knowledge. Therefore, this type of work is an important means of operational feedback. Practical classes perform not only cognitive and educational functions, but also contribute to the growth of graduate students as creative workers in the field of interest of researchers.

The main tasks of the class cycle:

- help graduate students systematize, consolidate and deepen knowledge of a theoretical nature in the field of their own innovations;
- to teach graduate students techniques for solving practical problems, to promote the mastery of skills and abilities to convey the results of their own research to colleagues and the scientific community;

- teach them to work with scientific and reference literature and diagrams;
- to form the ability to learn independently, that is, to master the methods, methods and techniques of self-learning, self-development and self-control.

6. Independent work

Independent work takes up to 63 % of the time of studying the credit module, including preparation for the credit. The main task of the independent work of graduate students is to master scientific knowledge in areas that are not included in the list of lecture questions by personally searching for information, forming an active interest in a creative approach to educational work. In the process of independent work within the framework of the educational component, the graduate student must learn to deeply analyze modern approaches to the development and implementation of the latest technologies and innovations in the direction of his own research.

You can independently complete the program of distance courses (Information resources on the Internet).

Politics and control

7. Policy of educational component

Rules of attending classes and behavior in classes

Attendance is a mandatory component of the assessment. Graduate 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 interfere with the teacher conducting classes, not to be distracted by activities unrelated to the educational process. Possible modes of operation: face-to-face, remote synchronous, remote asynchronous.

Rules for assigning incentive and penalty points

- incentive points can be awarded by the teacher exclusively for the performance of creative works in the educational component, but their sum cannot exceed 25% of the rating scale.
- penalty points are not provided within the educational component.

Policy of deadlines and rescheduling

In the event of arrears from the educational component or any force majeure circumstances, graduate students should contact the teacher through the available (provided by the teacher) communication channels to resolve problematic issues and agree on the algorithm of actions for practice.

Policy of academic integrity

Plagiarism and other forms of dishonest work are unacceptable. Plagiarism refers to the absence of references when using printed and electronic materials, quotes, opinions of other authors. Inadmissible tips and write-offs during writing tests, conducting classes; taking a test for another graduate 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 Chapter 3 of the Code of Honor of the National Technical University of Ukraine "Ihor Sikorsky Kyiv Polytechnic Institute". More details: <https://kpi.ua/code>

Policy of academic behavior and ethics

Graduate students must be tolerant, respect the opinions of others, formulate objections in the correct form, and constructively support feedback during classes.

Standards of ethical behavior of students and employees are defined in Chapter 2 of the Code of Honor of the National Technical University of Ukraine "Ihor Sikorskyi Kyiv Polytechnic Institute". More details: <https://kpi.ua/code>

8. Types of control and rating system for evaluating learning outcomes (RS)

Distribution of educational time by types of classes and tasks in the discipline:

Semester	School time		Distribution of training hours				Control measures		
	Credits	Acad.	Lecture	Practical	Lab.	IWS	MC	ect	Semester

		<i>h.</i>		<i>(seminary)</i>					<i>control</i>
3	5	150	28	28	-	94	-	-	Exam

The student's rating consists of points that he receives for:

- work in practical/seminar classes and reporting on the SRS;
- semester control in the form of an exam.

Rating (weighting) points system and assessment criteria

Completion of tasks in practical (seminar) classes and reporting on the IWS.

The weighting point is 8 points (5 tasks) and 10 points (1 task); 6 tasks are provided.

Criteria for assessing task performance:

The task is completed in full: Up to 8 (10) points

Minor shortcomings under item 1: Up to 7 (9) points

Untimely completion of the task: Up to 5 (7) points

Untimely completion of the task, shortcomings under item 1: Up to 4 points

Poor quality, untimely completion of the task: Up to 2 points

Failure to complete the task: 0 points

Thus, the rating semester scale is:

$$R_c = 8 \times 5 + 10 \times 1 = 50 \text{ points}$$

If calendar control is provided, then according to the results of the educational work for a certain time, the postgraduate student must score half of the maximum number of points for this period of study.

Semester control is an exam. Admission to the exam is the presence of at least 10 points received in the semester. To receive the exam "automatically" you need to have a rating of at least 50 points.

The examination ticket contains 5 questions that relate to different sections of the educational component and takes place in the form of an interview.

Performance evaluation criteria

The question is fully disclosed, all the main and additional data are provided: 95-100 points

Minor shortcomings that do not significantly affect the results: 75-94 points

Incomplete answer, some secondary data are not provided. Shortcomings that affect the result, but the graduate student's actions are correct. The graduate student can independently correct the answer for correct results: 50-74 points

Incomplete answer, some main data are not provided. Shortcomings that affect the result, but the graduate student's actions are correct. The graduate student can correct the answer provided that additional material is used: 20-50 points

Poor quality, task execution. The answer contains significant errors. The result is incorrect, but the graduate student's actions are correct. The graduate student cannot correct the results without additional help from the teacher and the use of additional material: Up to 20 points

Failure to complete the task, no answer: 0 points/

Thus, the rating scale for the educational component is:

$$R = R_c + R_e = 50 + 50 = 100 \text{ points}$$

The maximum sum of points is 100/

To obtain the final score, the sum of all received rating points R is converted according to the table:

Score	Score
95... 100	Perfectly
85... 94	very good

75...84	well
65... 74	Satisfactory
60...64	enough
RD < 60	Disappointing
Admission conditions not met	not allowed

Additional information on the educational component

The following courses are included:

<https://ipp.eng.unimelb.edu.au/for-students>

<https://au.linkedin.com/in/innovation-practice-program-0a0180171>

https://www.udemy.com/course/disruptive-innovation-business-model-startup/&utm_medium=udemyads&utm_source=adwords&utm_term=._ag_84635077608._ad_388109814158._.kw_%2Binnovation+%2Bcourse._de_c._dm_.pl_.ti_kwd-519656023575._li_9061016._pd_.

<https://www.port.ac.uk/study/courses/beng-hons-innovation-engineering>

Other courses may be enrolled upon consultation with the instructor.

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

Approximate list of questions that can be submitted to the control

What is engineering

Emergence of concepts and types

Engineering services

Global and domestic engineering trends

Pre-project engineering

Project engineering

Post-project engineering

Complex engineering

Construction engineering

Financial engineering

Industrial engineering

Direct engineering and reengineering

TVVZ-engineering

Differences between engineering and design

Systems of training and certification of project managers

Ukraine's integration into the world economic space

International markets of engineering services

International engineering trends

The role of Ukraine in the world market of engineering services

Organizational and economic measures regarding engineering and consulting activities

The concept of "innovation"

Engineering typology of innovative activity

Components of innovative management

Technical innovations

Organizational innovations

Information innovations

Social innovations

Specialized services for implementation of innovative processes at machine-building enterprises

Three stages of the innovation process

Life cycle of innovations

Life cycle of machine-building products

Organizational and technical measures to reduce the time of the innovation process

GDR product design

Fundamental research
Research studies
Applied research
Four groups of applied studies
Three relatively independent stages of DKR
The system of state standards that determine the composition of the stages of DKR
Scientific and technical level
NTR assessment procedure
Innovative policy of the enterprise
Stages of development and implementation of the innovative policy of the enterprise
Resource saving methods
Resource saving strategies at the enterprise
Economic stability
Economic condition of the enterprise
Stable condition of the enterprise
The influence of the Internet on production efficiency
Reducing the duration of the production cycle
Formation of the product concept
New product design phase
The phase of development of production and promotion of a new product to the market
Principles of concurrent engineering
Design preparation for the production of a new product
Operational and production manufacturability, unification, standardization
Technological support of new production
Evaluation of innovative projects
Theory of innovation processes
Formation of technological systems and diffusion of innovations
Concepts of innovation market regulation
The price of innovation
The concept of technological structures
Stages of competitiveness
The concept of state regulation of innovative activity
Innovation risks
Types of risks in innovation processes
Requirements for an innovator specialist: Matchtech Engineering Recruitment Specialists
Natural sources of innovation are engineering and invention
What are disruptive innovations?
Key Characteristics of Disruptive Innovators
What is Disruptive Innovation?
Key Characteristics of Destructive Innovators
Why Does the Difference Between Disruptive and Disruptive Innovation Matter?

Working program of the educational component (syllabus):

Compiled by Assoc. Prof. Sidorov D.E.

Approved by the Department of CPSI (Protocol No. 17 dated 04.06.2025)

Approved by the Methodical Commission of the Faculty of CE (Protocol No. 11 of 27.06. 2025)