



## Syllabus Course Program

# Calculation and Construction of Volumetric Hydropneumatic Machines and Hydropneumatic Drives

### Specialty

131 – Applied Mechanics

### Educational program

Applied Mechanics

### Level of education

Bachelor's level

### Semester

5

### Institute

Institute of Education and Science in Mechanical Engineering and Transport

### Department

Hydraulic machines named after G. F. Proskura (150)

### Course type

Professional, Selective

### Language of instruction

English, Ukrainian

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## Lecturers and course developers



### Nadiia Fatieieva

[nadiia.fatieieva@khpi.edu.ua](mailto:nadiia.fatieieva@khpi.edu.ua)

Candidate of Technical Sciences, Assistant Professor, Assistant Professor of the Department of Hydraulic machines named after G. F. Proskura

Author and co-author of more than 30 scientific and methodological publications.

Courses: "Fundamentals of Hydraulic Drive Theory", "Design of Volumetric Hydraulic Machines and Hydraulic Drives for the Oil and Gas Industries", "Reliability, Operation and Maintenance of Hydraulic Machines", "Machines and Equipment for Oil and Gas Drilling", "Construction and calculation of volumetric hydraulic machines", "Modern Scientific Schools of the Department".

[More about the lecturer on the department's website](#)



### Oleksandr Fatyeyev

[oleksandr.fatyeyev@khpi.edu.ua](mailto:oleksandr.fatyeyev@khpi.edu.ua)

Candidate of Technical Sciences, Assistant Professor of the Department of Hydraulic machines named after G. F. Proskura

Author and co-author of more than 30 scientific and methodological publications.

Courses: "Proportional Hydraulics", "Modern Technologies in Applied Mechanics", "Workflows of modern industries", "Certification and Metrological Quality Assurance", "Theory of Automatic Control".

[More about the lecturer on the department's website](#)

## General information

### Summary

The course "Calculation and construction of volumetric hydropneumatic machines and hydropneumatic drives" studies calculation methods and general principles of designing volumetric hydropneumatic machines and hydropneumatic drives.

### Course objectives and goals

To form and develop students' scientific and practical outlook, modern forms of theoretical thinking, to acquire knowledge in the field of hydropneumatic drives, calculation and design of volumetric hydropneumatic machines and hydropneumatic drives necessary for further mastering special disciplines and practical activities in the specialty.

### Format of classes

Lectures, practical classes, laboratory classes, consultations, self-study. Individual calculation assignment. Final control in the form of an exam.

### Competencies

GC01. Ability to think abstractly, analyse and synthesise.

GC03. Ability to identify, formulate and solve problems.

GC04. Ability to apply knowledge in practical situations.

GC07. Ability to learn and master modern knowledge.

GC12. Ability to search, process and analyse information from various sources.

PC01. Ability to analyse materials, structures and processes based on the laws, theories and methods of mathematics, natural sciences and applied mechanics.

PC04. Ability to make the optimal choice of technological equipment, complete set of technical complexes, have a basic understanding of the rules of their operation.

PC09. Ability to present the results of their engineering activities in accordance with generally accepted norms and standards.

### Learning outcomes

LO01. Select and apply suitable mathematical methods to solve problems of applied mechanics.

LO06. Create and theoretically substantiate the construction of machines, mechanisms and their elements on the basis of applied mechanics, general design principles, the theory of interchangeability, standard methods of calculating machine parts.

LO07. Apply regulatory and reference data to control the compliance of technical documentation, products and technologies with standards, specifications and other regulatory documents.

### Student workload

The total volume of the course is 150 hours (5 ECTS credits): lectures – 32 hours, practical classes – 16 hours, laboratory classes – 16 hours, self-study – 86 hours.

### Course prerequisites

To successfully complete the course, you must have knowledge and practical skills in the following disciplines: "Hydraulics, hydraulic and pneumatic drives", "Fundamentals of hydraulic drive theory".

### Features of the course, teaching and learning methods, and technologies

Lectures are delivered using multimedia technologies. Practical and laboratory classes use a project-based approach to learning, game methods, and focus on the use of information technology in the calculation and construction of volumetric hydropneumatic machines and hydropneumatic drives.

Educational materials are available to students through OneDrive, Whiteboards, on the educational platform of NTU "KhPI" <https://dlc.kpi.kharkov.ua/course/view.php?id=1853>

## Program of the course

### Topics of the lectures

#### Topic 1. Introduction to the course.

The field of application of hydropneumatic drives. Typical principle schemes of hydropneumatic systems of various technological machines.

#### Topic 2. Hydraulic fluids. Properties of air as a working body of transfer.

Functions of the hydraulic fluid. Compressed air production and distribution.

#### Topic 3. Filtration in hydraulic systems.

Functions of filters in hydraulic systems.

#### Topic 4. Application features of pneumatic drives.

Structure of a pneumatic drive. Element base of pneumatic drives.

#### Topic 5. Volumetric pumps. Constructional design.

Functioning of hydraulic drives.

#### Topic 7. Basics of hydraulic drive calculation.

Development of the drive principle scheme. Preliminary calculation of hydraulic drives.

#### Topic 8. Thermal condition in hydraulic systems.

Topic 9. Basics exploitation of hydraulic drives. Basic exploitation of pneumatic drives.

Commissioning of hydraulic drives. Technical maintenance of hydraulic drives. Exploitation of pneumatic drives. Mounting and adjustment of pneumatic drives.

### Topics of the workshops

Topic 1. Calculation of construction of hydrofilters. Practical examples of calculating filter parameters.

Topic 2. Calculation of pneumatic engines.

Topic 3. Volumetric pumps. Characteristics of an unregulated volumetric pump.

Topic 4. Technical characteristics of the hydraulic cylinder with one-way rod.

Topic 5. Calculation of a volumetric rotary drive.

Topic 6. Calculation of a volumetric hydraulic drive for translational action.

Topic 7. Algorithms for technical diagnostics of hydraulic systems.

### Topics of the laboratory classes

Topic 1. Study of the construction and testing of filters.

Topic 2. Study of the construction and testing of volumetric hydraulic and pneumatic engines.

Topic 3. Study of the construction and testing of volumetric pumps.

Topic 4. Study of the construction and testing of hydraulic and pneumatic directional valves.

Topic 5. Study of the construction and testing of pressure valves.

Topic 6. Study of the construction and testing of non return valves and pilot operated check valves.

Topic 7. Study of the construction and testing of throttle valves and flow control valves.

Topic 8. Study of the construction of hydraulic tanks.

### Self-study

Study of lecture material. Individual study of topics and issues that are not covered in lectures. The course involves completing an individual calculation assignment on the calculation and construction of volumetric hydropneumatic machines and hydropneumatic drives. The results of the calculations are presented in a written report. Students are also recommended additional materials (videos, literature, articles) for self-study and analysis.

## Course materials and recommended reading

### Compulsory materials

1 Буслов В. К. Об'ємний гідропривод. Конспект лекцій. Київ: НТТУ «КПІ», 2009. 246 с.

2 Дранковський В. Е., Миронов К. А., Фатеева Н. М., Резва К. С., Крупа Є. С. Технічна термодинаміка, гідравліка і гідромашини: навч. посібник у 2 ч. Харків: НТУ "ХПІ", 2020. 223 с.

3 Яхно О. М., Чебан В. Г., Фінкельштейн З. Л., Лур'є З. Я., Чекмасова І. А. Розрахунок, проектування та експлуатація об'ємного гідроприводу. Київ: НТТУ «КПІ», 2006. 216 с. <http://library.kpi.kharkov.ua>

4 Погорілець О. М., Волянський М. С., Войтюк В. Д., Пастушенко С. І. Гідропривод сільськогосподарської техніки. Київ: Вища освіта, 2004. 368 с.

5 Буренніков Ю. А., Немировський І. А., Козлов Л. Г. Гідравліка, гідро- та пневмоприводи. Вінниця: ВНТУ, 2013. 273 с. <http://library.kpi.kharkov.ua>

6 Сидоренко В. П., Яхно О. М. Гідравліка і гідроприводи. Київ: Університет "Україна", 2008. 163 с.

### Additional materials

1 Гевко Б. М., Білик С. Г., Ліник А. Ю., Фльонц О. В. Гідропривод і гідроавтоматика сільськогосподарської техніки. Тернопіль: ТНТУ ім. Івана Пулюя, 2015. 384 с. <http://elartu.tntu.edu.ua/handle/lib/20811>

2 Лисак В. А. Гідропривід механізмів і машин. Електронний навчально-методичний комплекс. Київ, 2016. [http://www.shevchenkove.org.ua/person\\_syte/Lusak/](http://www.shevchenkove.org.ua/person_syte/Lusak/).

## Assessment and grading

### Criteria for assessment of student performance, and the final score structure

Description of the final score structure, course requirements, and necessary steps to earn points, especially paying attention to self-study and individual assignments.

### Grading scale

Total points	National	ECTS
90–100	Excellent	A
82–89	Good	B
75–81	Good	C
64–74	Satisfactory	D
60–63	Satisfactory	E
35–59	Unsatisfactory (requires additional learning)	FX
1–34	Unsatisfactory (requires repetition of the course)	F

## Norms of academic integrity and course policy

The student must adhere to the Code of Ethics of Academic Relations and Integrity of NTU "KhPI": to demonstrate discipline, good manners, kindness, honesty, and responsibility. Conflict situations should be openly discussed in academic groups with a lecturer, and if it is impossible to resolve the conflict, they should be brought to the attention of the Institute's management. Regulatory and legal documents related to the implementation of the principles of academic integrity at NTU "KhPI" are available on the website: <http://blogs.kpi.kharkov.ua/v2/nv/akademichna-dobrochesnist/>

## Approval

Approved by

30.06.2023

Head of the department  
Andrii ROGOVYI

Guarantor of the educational program  
Mykola PROKOPENKO