



## Syllabus Course Program



# Operation of hydraulic pneumatic drives of technological equipment

**Specialty**

131 – Applied Mechanics

**Institute**

Educational-scientific Institute of Mechanical Engineering and Transport

**Educational program**

Applied Mechanics

**Department**

Hydraulic Machines (150)

**Level of education**

Master's level

**Course type**

Optional course

**Semester**

2

**Language of instruction**

English

## Lecturers and course developers

**Andrii Rogovyi**

[Andrii.Rogovyi@khp.edu.ua](mailto:Andrii.Rogovyi@khp.edu.ua)

Doctor of Technical Sciences, Professor, Head of the Department

Author of more than 200 scientific and educational works. Leading lecturer in the courses: "Modeling and calculation of viscous fluid flows", "Mathematical modeling of work processes in hydraulic machines", "Numerical study of spatial flow in hydraulic machine channels". He defended his dissertation on "Development of the theory and methods of calculation of vortex chamber superchargers".

**Oleksandr Hasiuk**

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Candidate of Technical Sciences, Associate Professor

Author of more than 50 scientific and educational works, including 5 textbooks and manuals with the stamp of the Ministry of Education and Science, 25 patents for utility models.

Leading lecturer in the following disciplines: "Dynamics of hydraulic pneumatic systems", "Technology of manufacturing of hydraulic pneumatic drives", "Operation and diagnostics of hydraulic pneumatic systems".

## General information

### Summary

The course "Operation of Hydropneumatic Actuators for Process Equipment" is aimed at familiarizing participants with the principles, design and effective use of hydropneumatic actuators in process equipment. The course provides students and professionals with high-quality theoretical and practical knowledge necessary for effective work with hydropneumatic systems. The main topics of the course include studying the principles of hydropneumatic systems, analyzing the designs and main components of drives, learning the rules of installation and maintenance of equipment. In addition, participants will receive information on various methods of diagnosing and restoring systems in case of malfunctions. During the course, students will be involved in solving practical problems and using modern equipment, which will allow them to gain real experience with hydropneumatic equipment. In addition, participants will be familiarized with current trends in the industry and the latest technologies that affect the development of hydropneumatic systems

### Course objectives and goals

Familiarization with the principles, design and effective use of hydropneumatic actuators in technological equipment.

### Format of classes

Lectures, consultations. Final control - test

### Competencies

GC6. Ability to communicate with representatives of other professional groups of different levels (with experts from other fields of knowledge/ types of economic activity).

PC2. Ability to critically analyze and predict the performance parameters of new and existing mechanical structures, machines, materials and production processes of mechanical engineering based on knowledge and use of modern analytical and/or computerized methods and techniques.

PC3. Application of appropriate methods and resources of modern engineering based on information technology to solve a wide range of engineering problems using the latest approaches, forecasting methods with awareness of the invariance of solutions.

PC9. Ability to work independently and function effectively as a group or structural unit leader in the performance of production tasks, complex projects, and research. Responsibility for the development of professional knowledge and practices, assessment of the strategic development of the team.)

### Learning outcomes

LO9. Organize the work of the group in the implementation of tasks, complex projects, research, understand the work of others, give clear instructions.

LO11 Develop managerial and/or technological solutions under uncertain conditions and requirements, evaluate and compare alternatives, analyze risks, predict possible consequences.

LO15 Demonstrate knowledge of the structure, functioning, hardware and software of information and measurement computerized systems in mechanical engineering production.

LO16 Demonstrate knowledge and understanding of the basics of production process organization

### Student workload

The total volume of the course is 90 hours (3 ECTS credits): lectures - 32 hours, self-study - 58 hours.

### Course prerequisites

Work processes of modern production facilities

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

The lectures use video materials, interactive techniques, logical methods, work with scientific literature, and the preparation of graphic diagrams and tables. In order to acquire skills of independent work each student performs creative tasks in the course of study.

The material is available on the Microsoft 365 resource and on the Moodle platform

## Program of the course

### Topics of the lectures

- Topic 1: Basic principles of hydropneumatic systems.
- Topic 2. Design of hydropneumatic actuators
- Topic 3. Installation and maintenance of hydropneumatic equipment.
- Topic 4. Control systems for hydropneumatic actuators.
- Topic 5. Diagnostics and repair of hydropneumatic systems.
- Topic 6. Safety of operation of hydropneumatic equipment.
- Topic 7. Innovations in the field of hydropneumatic technologies.
- Topic 8. Practical applications of hydropneumatic equipment.
- Topic 9. Environmental aspects of hydropneumatic technologies.
- Topic 10. Future development of hydropneumatic systems.
- Topic 11. Hydropneumatic robotic systems.
- Topic 12. Influence of hydropneumatics on the design of technical systems.

### Topics of the workshops

Practical classes are not provided within the course

### Topics of the laboratory classes

Laboratory works are not provided within the course

### Self-study

Study the lecture material. Preparation for practical classes. Independent study of topics and issues that are not covered in lectures

## Course materials and recommended reading

1. Stryczek, J., & Warzyńska, U. (Eds.). (2020). Advances in Hydraulic and Pneumatic Drives and Control 2020. Springer Nature.
2. Guha, P. K. (2018). Hydraulic Pumps & Motors and their Applications. Dog Ear Publishing.
3. Manring, N. D., & Fales, R. C. (2019). Hydraulic control systems. John Wiley & Sons.
4. Vacca, A., & Franzoni, G. (2021). Hydraulic fluid power: fundamentals, applications, and circuit design. John Wiley & Sons.
5. Tan, K. K., Putra, A. S., Tan, K. K., & Putra, A. S. (2011). Servo hydraulic and pneumatic drive. Drives and Control for Industrial Automation, 9-44.
6. Tan, K. K., & Putra, A. S. (2010). Drives and control for industrial automation. Springer Science & Business Media.
7. Ilango, S., & Soundararajan, V. (2011). Introduction to hydraulics and pneumatics. PHI Learning Pvt. Ltd.

## Assessment and grading

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

100% of the final grade consists of the results of the current assessment

Current assessment: quizzes, online test, defense of individual work (40%).

### 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

Date, signature

**Head of the department**  
Andrii ROGOVYI

Date, signature

**Guarantor of the educational program**  
Volodymyr Rubashka