



Syllabus Course Program



Навчально-науковий інститут
механічної інженерії і транспорту

Hydraulics

Specialty

131 – Applied mechanics

Educational program

Applied mechanics

Level of education

Bachelor's level

Semester

7

Institute

Institute of Education and Science in Mechanical Engineering and Transport

Department

Machine Components and Hydropneumatic Systems" (148)

Course type

Special, Mandatory

Language of instruction

English

Lecturers and course developers



Volodymyr KLITNOI

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PhD, Docent, Associate Professor at the Department of Machine Components and Hydropneumatic Systems of the Educational and scientific institute of mechanical engineering and transport of the NTU «KhPI»

Author of more than 100 scientific and educational publications. Leading lecturer of the courses: «Applied Mechanics», «Technical Mechanics», «Machine Elements», «Hydraulics».

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



Mariana Stryzhak

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D. in Engineering, Associate Professor, Associate Professor of the Department of Machine Parts and Hydropneumatic Systems of NTU "KhPI"

Author of more than 60 scientific and educational publications. Leading lecturer in the courses: "Theory of Automatic Control and Dynamics of Mechatronic Systems", "Modern Element Base of Mechatronic Systems", "Volumetric Hydraulic Machines", "Fundamentals of Calculation and Design of Electro-Hydraulic and Electro-Pneumatic Transducers", "Fundamentals of Scientific Research".

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

General information

Summary

Knowledge of this course is necessary for a correct understanding of the physical processes occurring in liquid media, and, therefore, for a correct understanding of the principles of calculation and design of pipelines, hydraulic machines, etc.

Course objectives and goals

Acquaintance of students with the basic laws of hydraulics, principles of operation of hydraulic machines, individual hydraulic devices used in mechanical engineering, and their calculation methods.

Format of classes

Lectures, practical works, laboratory works, consultations, self-study. Final control in the form of an test.

Competencies

ZK2. Ability to apply knowledge in practical situations.

FK1. Ability to apply typical analytical methods and computer software tools for solving engineering problems of industrial mechanical engineering, effective quantitative methods of mathematics, physics, engineering sciences, as well as appropriate computer software for solving engineering problems of industrial mechanical engineering.

FC7. The ability to make effective decisions regarding the selection of construction materials, equipment, processes and to combine theory and practice to solve an engineering task.

FC8. The ability to realize creative and innovative potential in project development in the field of mechanical engineering.

FC10. The ability to develop plans and projects in the field of industrial mechanical engineering under uncertain conditions, aimed at achieving the goal taking into account existing limitations, solving complex tasks and practical problems of improving product quality and its control.

Learning outcomes

RN 2. Knowledge and understanding of mechanics and mechanical engineering and prospects for their development.

RN 4. Carry out engineering calculations to solve complex problems and practical problems in industrial mechanical engineering.

RN 5. Analyze engineering objects, processes and methods.

RN 8. Understand the relevant methods and have the skills to design typical nodes and mechanisms in accordance with the task.

Student workload

The total volume of the course is 120 hours (4 ECTS credits): lectures - 32 hours, practical works - 16hours, laboratory works - 16 hours, self-study - 56 hours.

Course prerequisites

Knowledge, skills, and previous courses that are necessary for successful course completion.

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

Interactive lectures with presentations, discussions, organization of independent work of students, development of abilities and skills during workshops.

Program of the course

Topics of the lectures

Topic 1. Introduction. Science of hydraulics. Liquid and its properties.

Topic 2. Basics of hydrostatics.

Topic 3. Basics of hydrodynamics. Basic concepts and definitions.

Topic 4. Fluid movement modes: laminar and turbulent.

Topic 5. Energy characteristics of liquid flow. Bernoulli's equation.

Topic 6. Pressure losses in the pipeline.

Topic 7. Throttle elements of hydraulic drives. Fluid consumption through the throttle.

Topic 8. Unsteady movement of liquid in pipelines. Hydraulic shock

Topics of the workshops

Topic 1. Properties of liquids and gases.

Topic 2. Determination of pressure in the stream. The main equation of hydrostatics.

Topic 3. Fluid movement. Pressure losses.

Topic 4. Hydraulic calculation of simple hydrolines.

Topics of the laboratory classes

Topic 1. Devices for measuring pressure. Tare spring manometer.

Topic 2. Fluid movement in a pipe of variable cross-section. Using the Bernoulli equation.

Topic 3. Fluid flow modes.

Topic 4. Pressure losses along the length of the pipeline. Local supports.

Topic 5. Liquid leaks. Nozzles, diffusers.

Self-study

The course involves the implementation of an individual calculation tasks, preparation for an oral and written survey in practical classes.

Course materials and recommended reading

1. Andrew Parr Hydraulics and Pneumatics. A Technician's and Engineer's Guide. — 2nd ed., 1999 –210 p.
2. Zoeb Husain, Mohd. Zulkifly Abdullah, Zainal Alimuddin Basic Fluid Mechanics and Hydraulic Machines BS Publications, 2008. 234 p.
3. Oertel, H. Introduction to Fluid Mechanics - University of Karlsruhe, 2005. 167 p.

Assessment and grading

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

100% of the final grade consists of assessment results in the form of credit (40%) and current assessment (60%).

Assessment: written assignment (2 questions from theories + problem solving) and an oral report.

Current assessment: calculation task (40%).

Laboratory works (20%).

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-dobrochnest/>

Approval

Approved by

30.08.2024



Head of the department
Volodymyr KLITNOI

30.08.2024

Guarantor of the educational
program
Alexander PERMYAKOV