



## Syllabus Course Program



Навчально-науковий інститут  
механічної інженерії і транспорту

# Technical Mechanics

### Specialty

141 – Electric Power, Electrical Engineering and Electromechanics

### Educational program

Electromechanics

### Level of education

Bachelor's level

### Semester

3

### 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

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## 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

The course covers all aspects of technical systems development. During its study, the main attention is paid to the issues of kinematics and dynamics of the material system of bodies, the formation of knowledge about the features of structural calculations for strength, the development of skills in engineering design of general-purpose parts.

## Course objectives and goals

To deepen students' understanding of the basics of kinematic and power analysis of technological equipment, development of students' skills for calculations of the strength and rigidity of the most dangerous structural elements, acquisition of knowledge by students to perform the design of general-purpose machine elements.

## Format of classes

Lectures, workshops, consultations, self-study. Final control in the form of an test.

## Competencies

K01. Ability to abstract thinking, analysis and synthesis.

K02. Ability to apply knowledge in practical situations.

K03. Ability to communicate in the national language both orally and in writing.

K05. Ability to search, process and analyze information from various sources.

K06. Ability to identify, pose and solve problems.

K07. Ability to work in a team.

K08. Ability to work autonomously.

K09. The ability to realize one's rights and responsibilities as a member of society, to realize the values of a civil (free democratic) society and the need for its sustainable development, the rule of law, the rights and freedoms of a person and a citizen in Ukraine.

K12. The ability to solve practical problems involving the methods of mathematics, physics and electrical engineering.

K14. The ability to solve complex specialized tasks and practical problems related to problems of metrology, electrical measurements, the operation of automatic control devices, relay protection and automation.

K23 The ability to develop simple structures of electric power and electrotechnical objects and to evaluate the mechanical strength of the developed structures...

## Learning outcomes

PR10. Find the necessary information in scientific and technical literature, databases and other sources of information, evaluate its relevance and reliability.

PR11. Communicate freely about professional problems in national and foreign languages orally and in writing, discuss the results of professional activity with specialists and non-specialists, argue one's position on debatable issues.).

PR15. Understand and demonstrate good professional, social and emotional behavior, follow a healthy lifestyle.

PR18. Be able to learn independently, acquire new knowledge and improve skills in working with modern equipment, measuring equipment and application software.

PR22. Know and be able to develop simple designs of electric power and electrotechnical objects and evaluate the mechanical strength of the developed designs.

## Student workload

The total volume of the course is 120 hours (4 ECTS credits): lectures - 32 hours, workshops - 16 hours, self-study - 72 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 Principal hypotheses and assumptions in mechanics of materials. Stress and Strain.
- Topic 2. Simple strain. Hooke's Law. Poisson's ratio.
- Topic 3. Geometric characteristics of plane sections. First and Second Moment of Area.
- Topic 3. Bending. Shear forces and bending moments. Hooke's Law for bending.
- Topic 4. Pure shear. Hooke's Law for shear. Torsion. Hooke's Law for torsion.
- Topic 6. Combined Loading. Fatigue Stress.
- Topic 7. Mechanical transmissions. Belt drive. Kinematic calculations. Sliding curves and efficiency. Strength calculations.
- Topic 8. Gear drive. Geometry. Fatigue calculations for contact and bending stresses.
- Topic 9. Shafts and axles. Geometry. Static and fatigue calculations.
- Topic 10. Rolling bearings. Classification and marking. Selection and test calculation for dynamic load capacity.
- Topic 11. Joining machine parts: threaded, keyed, slot, couplings.
- Topic 12. The basics of interchangeability. Shaft and hole system. Tolerances and landings. Construction of deviation fields. Surface roughness. Drawings.

### Topics of the workshops

- Topic 1. Axial Force, Torsion – Calculations.
- Topic 2. Centroid. First and Second Moment of Area for simple sections.
- Topic 3. Shear Force and Bending Moment Diagrams.
- Topic 4. Analysis of kinematic schemes and selection of the drive motor.
- Topic 5. The belt transmissions.
- Topic 6. The cylindrical gear transmissions.

### Topics of the laboratory classes

Laboratory work within the discipline is not provided.

### 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. Mechanics of materials / Ferdinand Beer ... [et al.]. — 6th ed., 2012 –758 p.
2. Khurmi R.S. A Textbook of Engineering Mechanics: Applied Mechanics / S. Chand & Co Ltd., 1997. — 779 p.
2. Feodosiev V.I. Advanced Stress and Stability Analysis: Worked Examples/ Springer / 2005. 427 p.
3. Juvinall R.C., Marchek K.M. Fundamentals of Machine Component Design / John Wiley & Sons, Inc., 2011. — 928 p. 5th Edition.
4. Ugural A.C. Mechanical Design of Machine Components / Second Edition. — CRC Press, Taylor & Francis Group, 2015. — XXXVIII, 967 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%). Written surveys (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-dobrochesnist/>

## Approval

Approved by

30.08.2024



**Head of the department**  
Volodymyr KLITNOI

30.08.2024

**Guarantor of the educational program**  
Alexander PERMYAKOV