Syllabus
Course Program

Machine parts

Specialty
131 – Applied mechanics

Institute
Institute of Education and Science in Mechanical Engineering and Transport

Educational program
Applied mechanics

Department
Machine Components and Hydropneumatic Systems" (148)

Level of education
Bachelor's level

Course type
Special, Mandatory

Semester
5, 6

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

The course covers all aspects of the development of technical systems, intended for the study and practical assimilation of methods of calculation and construction of parts, their connections and nodes, which are used in the vast majority of modern machines.

Course objectives and goals

The formation of those acquiring knowledge in mechanical engineering and transport of a modern level of technological culture, skills and competence to use general methods in solving specific problems of drawing, designing and calculating machine parts, as well as to solve optimization problems using methods of automated design systems.

Format of classes

Lectures, 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+120 hours (4 ECTS +4 ECTS credits): lectures - 48 hours+32 hours, laboratory works - 16 hours+16 hours, self-study - 72 hours+ 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. Technical requirements for details. Load information. Criteria for performance and calculation of machine parts.
Topic 2. Belt transmissions.
Topic 3. Chain transmissions.
Topic 4. Gears.
Topic 5. Cylindrical gears.
Topic 6. Bevel gears.

Topic 7. Worm transmissions.
Topic 8. Screw-nut transmission.
Topic 9. Shafts and axles.
Topic 10. Sliding bearings.
Topic 11. Rolling bearings.
Topic 12. Connection. Threaded connections.
Topic 13. Pluggable connections.
Topic 14. Welded joints. Calculation of welded joints.
Topic 15. Couplings.

Topics of the workshops

Workshops within the discipline is not provided.

Topics of the laboratory classes

Topic 1. Study of mechanical drives and parts of general purpose machines.
Topic 2. Determination of the efficiency of a multi-stage cylindrical reducer.
Topic 3. Deciphering gears and creating a table of gear parameters.
Topic 4. Study of the construction of a two-stage cylindrical reducer.
Topic 5. Study of the design of the worm gearbox and determination of its load capacity.
Topic 6. Study of the structure of rolling bearings. Conventional designations of rolling bearings.
Topic 7. Determination of the friction moment in rolling bearings depending on the load, rotation speed and lubrication conditions.
Topic 8. Testing of safety friction clutches on the DM-40 installation.

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%).
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-dobrochesnist/

Approval

Approved by 30.08.2024

Head of the department
Volodymyr KLITNOI

30.08.2024

Guarantor of the educational program
Alexander PERMYAKOV