



Syllabus Course Program



Technological Fundamentals of Machinebuilding

Specialty

131 –
Applied Mechanics

Educational program

Applied Mechanics

Level of education

Bachelor's level

Semester

6

Institute

Institute of Education and Science in Mechanical
Engineering and Transport

Department

Department of Mechanical Engineering
Technology and Metal-Cutting Machines (146)

Course type

Special (professional), Mandatory

Language of instruction

English, Ukrainian

Lecturers and course developers

**Maryna Ivanova**

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Candidate of Technical Sciences. Associate Professor. Associate Professor of the Department of Mechanical Engineering Technology and Metal-Cutting Machines

Work experience - 12 years. Co-author of more than 50 scientific works, 1 monograph, and 2 training manuals. Leading lecturer in courses: Introduction to Speciality. Introductory Practice; Mechanization and automation of technological processes; Equipment and Transportation of Machining Shops.

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

General information

Summary

The course "Technological Fundamentals of Machinebuilding" provides knowledge of the basic principles of organization and technological preparation for manufacturing various types of products and materials. In the course of training, students will learn how to organize, plan, control, and improve manufacturing processes, ensure product quality, and satisfy consumer needs.

Course objectives and goals

To give students in-depth systematic knowledge on general issues of the organization of mechanical engineering production, machining, and forming methods of various surfaces of machine parts. To form modern concepts and practical skills, which are necessary for a mechanical engineer to design technological processes of machine production and their control.

Format of classes

Lectures, laboratory classes, self-study, consultations. The final control is 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
GC06 Determination and perseverance in tasks and responsibilities
GC07 Ability to learn and master modern knowledge
GC12 Ability to search, process and analysis of information from various sources
GC13 Ability to evaluate and ensure quality of work performed
PC02 Ability to evaluate the performance parameters of materials, structures and machines under operating conditions and find appropriate solutions to ensure a given level of reliability of structures and processes, including in the presence of some uncertainty
PC03 Ability to carry out technological and technical and economic assessment of the effectiveness of the use of new technologies and technical means
PC09 Ability to present the results of their engineering activities in compliance with generally accepted norms and standards
PCc3.3 Ability to assign standard cutting modes and necessary cutting tools for each operation of the technological process when processing parts of mechanical engineering production
PCc3.6 Ability to select the necessary technological equipment for mechanical engineering production, justify and determine the appropriate transport and storage systems of sites and workshops.
PCs3.8 Ability to select the type of technological equipment, carry out design and equipment, carry out design and development work and organize its production

Learning outcomes

LO04 Evaluate the reliability of machine parts and structures under static and dynamic loading
LO06 Create and theoretically substantiate the design of machines, mechanisms and their elements on the basis of methods of applied mechanics, general principles of design, theory of interchangeability, standard methods of calculation of machine parts
LO07 Apply normative and reference data to control compliance of technical documentation, products and technologies with standards, specifications and other regulatory documents
LO10 Know the design, methods of selection and calculation, basics maintenance and operation of drives machine tool and robotic equipment;
PLO3.03 Know the features of the use of information technology in engineering activities
PLO3.04 Know the methods and means of mechanisation and automation of production processes
PLO3.11 Know the structure and methods of design of technological processes manufacturing of parts using automated systems of technological production preparation systems. To know the features of using automated equipment and automatic lines in the manufacture of engineering products

Student workload

The total volume of the course is 90 hours (3 ECTS credits): lectures - 24 hours, laboratory classes - 12 hours, self-study - 54 hours.

Course prerequisites

To successfully pass the course, it's required to have knowledge and practical skills in the following courses: Interchangeability, Standardization and Technical Measurements; Theoretical Mechanics; Machine Elements; Theory of mechanisms and machines

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

Lectures are held in an interactive form using multimedia technologies. In practical classes, a project approach to learning is used, attention is focused on the independent solution of individual tasks, and the use of video materials on methods of processing parts in mechanical engineering. Laboratory classes are planned to be performed in the laboratory of the department according to an individual assignment for a group of students. Study materials are available to students through the teacher's corporate disk.

Program of the course

Topics of the lectures

Topic 1. Basic concepts of engineering technology and manufacturing.

What is manufacturing. Manufacturing industries and products. Production quantity and product variety. Manufacturing capability. Production systems: facilities, manufacturing support systems. Trends in manufacturing: lean production and six sigma, globalization and outsourcing, environmentally conscious manufacturing, microfabrication and nanotechnology.

Topic 2. Materials in mechanical engineering and related processing methods

Metal casting. Glassworking. Shaping processes for plastics. Rubber-processing technology. Shaping processes for polymer matrix composites. Powder metallurgy. Processing of ceramics and cermets. Metal forming processes. Bulk deformation processes in metalworking. Sheet metalworking. Overview of metal machining. Grinding and other abrasive processes. Nontraditional machining and thermal cutting processes. Heat treatment of metals. Surface processing operations.

Topic 3. Basic principles of workpiece locating in machine tool

Basics of workpiece location (basing). Degrees of freedom. Forms of Location and classification of bases. Typical schemes of workpiece location. Change of bases. Organized and unorganized change of bases. Positioning the Clamps. Selecting Clamp Size and Force.

Topic 4. Allowances for mechanical processing

The concept of allowance. General and operating allowances. Analytical and tabular assignment of allowance. Calculation of allowances.

Topic 5. Accuracy in mechanical engineering and methods of its achievement

Parameters of the accuracy of the workpiece. Static and dynamic settings. Prerequisites for the occurrence of errors in static and dynamic settings. Ensuring the accuracy of mechanical processing.

Topic 6. Surface machining methods

Machining methods of cylindrical and shaped external surfaces of rotation. Machining methods of cylindrical and shaped internal surfaces of rotation. Machining methods of the plane surfaces, slots and pockets. Machining methods of gears. Machining methods of screws and threads.

Topic 7. Electrophysical and electrochemical processing methods.

Electrical discharge machining. Electrochemical treatment. Ultrasonic treatment. Radiation treatment processes. Plasma processing. Laser processing. Combined processing methods. Additive processing methods.

Topic 8. Quality control and product testing in mechanical engineering

Types of control. Control of geometric parameters. Control of internal defects.

Topic 9. Assembly processes in mechanical engineering

Classification of assembly processes. Organizational forms of assembly processes. Types of assembly. Control of assembly and testing of products.

Topics of the workshops

Topics of the laboratory classes

Topic 1. Machining a tapered surface on a lathe

Topic 2: Machining a threaded surface on a lathe

Topic 3. Gear processing on a gear hobbing machine

Topic 4: Gear processing on a gear milling machine

Topic 5. Machining a gear on a horizontal milling machine with a dividing head

Topic 6: Processing holes on a drilling machine

Self-study

The course involves performing an individual calculation task to analyze the manufacturability of a part and design a route for machining the surface of a part. Practical classes also require individual tasks to calculate cutting conditions, workpiece location, and fill in process documents. All calculation results are documented in a written report. Students are also recommended additional materials (videos, articles) for independent study and analysis

Course materials and recommended reading

Main references

1. Mikell P. Groover. Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, 7th Edition. 2019
2. Kapil Gupta. Advanced Manufacturing Technologies: Modern Machining, Advanced Joining, Sustainable Manufacturing. 2017
3. by Yoshimi Ito, Takashi Matsumura. Theory and Practice in Machining Systems. 2017

Additional references

1. Damir Godec, Joamin Gonzalez-Gutierrez, Axel Nordin, Eujin Pei, Julia Ureña Alcázar. A Guide to Additive Manufacturing (2022) <https://doi.org/10.1007/978-3-031-05863-9>

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

Date, signature

Head of the department
Oleksandr PERMYAKOV

Date, signature

Guarantor of the educational program
Mykola PROKOPENKO