Syllabus
Course Program

Higher Mathematics

Specialty
075 – Marketing

Institute
Educational and Scientific Institute of MECHANICAL ENGINEERING AND TRANSPORT

Educational program
Business-administration

Department
Higher Mathematics (155)

Level of education
Bachelor's level

Course type
General. Mandatory

Semester
1

Language of instruction
English

Lecturers and course developers

Iuliia PERSHYNA
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Doctor of Physical and Mathematical Science, Head of Department

Experience – 20 years. Author of more than 200 scientific and educational and methodological works. Leading lecturer in the discipline "Higher Mathematics".

General information, number of publications, main courses, etc
More about the lecturer on the department's website
https://web.kpi.kharkov.ua/vm/pro-kafedru/zaviduyuchij/

General information

Summary

The course covers all aspects of students' formation of a system of basic theoretical and practical mathematical knowledge and competences necessary for solving complex specialized tasks and problems in the spheres of business, trade and stock exchange activities, development of skills in mathematical research of applied problems, formation of logical thinking

Course objectives and goals

The course covers all aspects of students' formation of a system of basic theoretical and practical mathematical knowledge and competences necessary for solving complex specialized tasks and problems in the spheres of business, trade and stock exchange activities, development of skills in mathematical research of applied problems, formation of logical thinking.

Format of classes

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Competencies

GC03 - Ability to abstract thinking, analysis, synthesis.
GC09 - Ability to learn and master modern knowledge.

Learning outcomes

LO16. Demonstrate the skills of independent work, flexible thinking, openness to new knowledge, be critical and self-critical.

Student workload

The total volume of the course is 180 hours (6 ECTS credits): lectures - 32 hours, practical classes - 48 hours, self-study- 100 hours

Course prerequisites

To successfully complete the course, you must have knowledge and practical skills in the following basic disciplines: algebra, geometry (planimetry, stereometry), mathematical analysis (school course)

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

Interactive lectures with presentations, discussions

Program of the course

Topics of the lectures

Topic 1. Elements of linear algebra
Matrices. Determinants. Solution of systems of linear algebraic equations by the Kramer's rule and the Gauss method

Topic 2. Elements of vector algebra and analytic geometry
Coordinates of the vector. Scalar, vector, mixed products of vectors and their application. Plane. Straight line in plane and space. Curves of the second order.

Topic 3. Limits. Continuity of functions
Number set. Actions on sets. Elementary functions. Function definition area. The limit of a numerical sequence. The limit of a function. Calculation of limities using the first and second wonderfull limits. Continuity of functions. Breakpoints of a function and their classification.

Topic 4. Derivative. Differentiation technique
Definition of the derivative, its mechanical and geometric applications. Differentiation rules. Derivatives of basic elementary functions. Differential function. Application of the derivative in economic analysis. Derivatives and differentials of higher orders.

Topic 5. Application of the derivative function of one variable to the study of the function and construction of its graph
Basic theorems of differential calculus: theorems of Rolle, Cauchy and Lagrange. Monotonicity intervals, extremum points of a function. Convexity, concavity of the function graph, inflection points: necessary and sufficient conditions. Asymptotes of the function graph.

Topic 6. Indefinite integral
Concept of indefinite integral. Table of integrals. The simplest methods of integration. Integration methods

Topic 7. The definite integral and its application
Classes of integrable functions. Properties of the definite integral. Newton-Leibniz formula. Integration by parts and replacement of the variable in the definite integral. Calculation of the area of flat figures. Improper integrals.

Topic 8. Functions of several variables
The scope of defining a function of several variables. Partial derivatives of functions of several variables. Differentiation of implicitly given functions. Extrema of a function of two variables. The largest and smallest values of functions of several variables in a closed region. Scalar fields. Derivative in the direction. Gradient

Topics of the workshops

Topic 1. Elements of linear algebra
Matrices. Determinants. Solution of systems of linear algebraic equations by the Kramer's rule and the Gauss method

Topic 2. Elements of vector algebra and analytic geometry
Coordinates of the vector. Scalar, vector, mixed products of vectors and their application. Plane. Straight line in plane and space. Curves of the second order.

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Number set. Actions on sets. Elementary functions. Function definition area. The limit of a numerical sequence. The limit of a function. Calculation of limities using the first and second wonderfull limits. Continuity of functions. Breakpoints of a function and their classification.

Topic 4. Derivative. Differentiation technique
Differentiation rules. Derivatives of basic elementary functions. Differential function. Derivatives and differentials of higher orders.

Topic 5. Application of the derivative function of one variable to the study of the function and construction of its graph
Monotonicity intervals, extremum points of a function. Convexity, concavity of the function graph, inflection points: necessary and sufficient conditions. Asymptotes of the function graph.

Topic 6. Indefinite integral
Table of integrals. The simplest methods of integration. Integration methods

Topic 7. The definite integral and its application
Newton-Leibniz formula. Integration by parts and replacement of the variable in the definite integral. Calculation of the area of flat figures. Improper integrals.

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Topics of the laboratory classes

This field is filled in the same way if the curriculum includes laboratory classes.

Self-study

Students' independent work consists of studying lecture material, preparing for practical classes, and completing individual tasks (research and development).

Course materials and recommended reading

1. Kurpa L. V. Higher mathematics: Problems solving and variants of typical calculation. Volume 1.Kharkiv: NTU KhPI - 316 p.;

2. Kurpa L.V., Shmatko T.V. Differential and Integral Calculus for One Variable Functions – Kharkiv: NTU KhPI: 2017. – 324 p.;
3. Mulyk O. Calculus: part I. Differential calculus of function of one variable - Kyiv : Igor Sikorsky Kyiv Polytechnic Institute, 2022. – 117 p. ;
4. Zhuravska G.V. Higher Mathematics. Differential Calculus of a Function of One Variable. Elements of Theory – Kyiv : Igor Sikorsky Kyiv Polytechnic Institute, 2019. – 81 p

Assessment and grading

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

.In each semester, 100% of the final grade consists of assessment results in the form of an exam (20%) and ongoing assessment (80%).
Exam: written task and oral presentation.
Current assessment: independent works, control works and individual calculation tasks.

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

Head of the department
Iuliia PERSHYNA

Guarantor of the educational program
Olena PROKHORENKO