Syllabus
Course Program

Mathematical analysis. Part 2.

Specialty
113 - Applied mathematics

Institute
Institute of Computer Modeling, Applied Physics and Mathematics

Educational program
Computer and mathematical modeling

Department
Applied mathematics (170)

Level of education
Bachelor's degree

Course type
general, required

Semester
2

Language of instruction
English

Lecturers and course developers

Hanna Linnyk
Hanna.Linnyk@khpi.edu.ua
author of more than 60 scientific articles and methodical developments, main courses: mathematical analysis, computer science, linear algebra, mathematical physics

More about the lecturer on the department's website

Olena Odintsova
olena.odyntsova@khpi.edu.ua
senior lecturer

More about the lecturer on the department's website

General information

Summary

The course of mathematical analysis provides the necessary knowledge for the theoretical and practical training of engineers of this specialty in the assimilation of mathematical methods from the basics of the theory of limits of differential and integral calculus of functions of one variable

Course objectives and goals

Familiarization and mastering by students of mathematical theories and methods necessary for solving problems in the field of mechanics of a solid deformed body, dynamic processes, other engineering and information systems that provide an opportunity to analyze and model processes, phenomena

Format of classes

lectures, practical classes, independent work, consultations. Final control – exam

Competencies

ZK06. Ability to abstract thinking, analysis and synthesis.
FK01. Ability to use and adapt mathematical theories, methods and techniques to prove mathematical statements and theorems.
FK03. The ability to choose and apply mathematical methods for solving applied problems, modeling, design, management, forecasting, decision-making

Learning outcomes

PH02. To have basic principles and methods of mathematical, complex and functional analysis, linear algebra and number theory, analytical geometry, theory of differential equations, in particular partial differential equations, probability theory, mathematical statistics and random processes, numerical methods

Student workload

The totall volume of the discipline is 150 hours. (5 credits ECTS): lectures – 32 h., practical classes – 32 h., independent work – 86 h., calculation task, exam

Course prerequisites

Mathematical analysis. Part 1

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

Lectures are conducted interactively using multimedia technologies. Explanatory-illustrative, reproductive, problem-oriented methods and the method of critical thinking are used in lectures. The practical classes use the partially research method and the discussion method, the emphasis is on the application of practical problems from the subject in the field of computer science. Study materials are available to students through OneNote, Class Notebook.

Program of the course

Topics of the lectures

Topic 1. Integral calculus of a function of one variable.
The Riemann integral. Properties of the Riemann integral. Inequalities and mean value theorems. Evaluation of the value of the integral. Properties of the integral as a function of the upper bound. The existence of the original. Newton-Leibniz formula. Methods of calculating the Riemann integral. Geometric and physical applications of the Riemann integral.
Improper integrals of the first kind. Elementary properties of improper integrals of the first kind. Convergence of integrals from integral functions. Improper integrals of the second kind. Absolutely and conditionally convergent integrals. The main value of the divergent improper integral.

Topic 2. Differential calculus of a function of several variables.
Space Rn. Definition of metrics and sets in Rn. Open and closed sets. Functions in Rn. Boundaries and continuity. Elementary properties of continuous functions. Partial derivatives of functions of several variables. The full increment of a function of many variables. Complete differential of the first order. Application to approximate calculations. Derivatives and differentials of higher orders.
Theorem on mixed derivatives. Taylor's formula for a function of several variables. The extremum of a function of several variables. Conditional extremum. The method of uncertain Lagrange multipliers. Geometric applications of the differential calculus of functions of several variables.

Topic 3. Series.
Number series, signs of convergence. Sign-alternating and sign-changing series. Power series, Abel`s theorem. Operations with power series. McLaren series. Fourier series for a function with period. Riemann-Lebesgue Lemma. The Dirichlet integral. Fourier deries for even, odd functions and for a function with arbitrary period. Complex Fourier series. Fourier integral

Topics of the workshops

Topic 1. Integral calculus of a function of one variable.
Methods of calculating the Riemann integral. Geometric and physical applications of the Riemann integral. Calculation and investigation of the convergence of improper integrals of the first and second kind.

Topic 2. Differential calculus of a function of several variables.
Finding the partial derivatives of a function of several variables. The full increment of a function of many variables. Complete differential of the first order. Application to approximate calculations. Derivatives and differentials of higher orders. Taylor's formula for a function of several variables. Finding the extrema of a function of several variables. Conditional extremum. The method of uncertain Lagrange multipliers. Geometric applications of the differential calculus of functions of several variables.

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Topics of the laboratory classes

Not provided for in the curriculum.

Self-study

The calculation task consists of three parts: integral calculation (10 points), differential calculation (10 points), series (10 points). Processing of lecture material. Preparation for practical classes. Preparation for control works..

Course materials and recommended reading

Assessment and grading

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

Independent work (30 points)
Tests (30 points)
Colloquium (20 points)
Exam (20 points).

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": show discipline, good manners, goodwill, honesty, responsibility. Conflict situations should be openly discussed in study groups with the teacher, and if it is impossible to resolve the conflict, they should be brought to the attention of the staff of the Institute's directorate.
Regulatory and legal support for the implementation of the principles of academic integrity of NTU "KhPI" is available on the website: http://blogs.kpi.kharkov.ua/v2/nv/akademichna-dobrochesnist/

Approval

Approved by	Date, signature	Head of the department Vyacheslav BURLAYENKO
	Date, signature	Guarantor of the educational program Gennadiy LVOV