



Syllabus of the educational component
Program of educational discipline

Higher mathematics. Part 2

Code and name of specialty
161 – Chemical technologies and engineering

Institute
Scientific and Educational Institute of Chemical Technology
and Engineering

Educational program
161.03 Technology of oil, gas and solid fuel refining
processes

Department
Higher Mathematics (155))

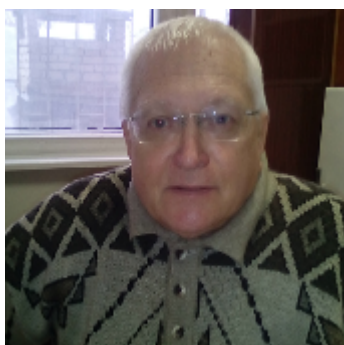
Educational level
Bachelor

Type of discipline
Mandatory

Semester
2

Language of teaching
English

Teachers, developers general information



Evhen Pavlovych HOMOZOV
yevgen.gomozov@khpi.edu.ua

Candidate of mathematical and physical sciences

Work experience - 44 years. Author of more than 150 scientific and educational and methodological publications. Leading lecturer in the discipline "Higher Mathematics".

General information, number of publications, main courses, etc.
Learn more about the teacher on the department's website

Abstract

The discipline is included in the educational and professional program of bachelor's training. The educational discipline "Higher mathematics. Ch2" is aimed at forming students' theoretical knowledge and developing practical skills in the use of mathematical apparatus, which helps to analyze and model various processes with the use, if necessary, of information and communication technologies.

The purpose and objectives of the discipline

To theoretically and practically prepare students for the assimilation of modern mathematical methods that provide an opportunity to solve practical problems related to the solution of complex specialized problems and practical problems of chemical technologies and engineering.

Format of classes

Lectures, practical classes, consultations. Individual calculation task. Final control - exam.

Competences

K01 - Ability to abstract thinking, analysis and synthesis.

Learning outcomes

PR01 - Know mathematics, physics and chemistry at the level necessary to achieve the results of the educational program

Scope of the discipline

The total volume of the discipline is 120 hours. (4 ECTS credits): lectures – 32 hours, practical classes – 32 hours, independent work – 56 hours.

Prerequisites for studying the discipline (prerequisites)

The prerequisite for studying the discipline is the knowledge and competences acquired by students in general educational institutions when studying algebra and geometry.

Features of the discipline, methods and technologies of education

The entire course is presented using a systematic approach for the formation of systemic knowledge, holistic ideas about the discipline, formation of synthesis skills, comparison and generalization of information.

Lectures

Are provided for the disclosure in verbal form of the essence of phenomena, scientific concepts, processes that are logically connected to each other and united by a common theme with an emphasis on their importance and use in the future specialty. They are accompanied by the use of multimedia equipment to provide clarity to illustrative materials, the demonstration of chemical experiments with the aim of forming cognitive interests of students, as well as active learning methods, such as creating problem situations.

Practical training

They are intended for the organization of practical educational work as defined and provide for the consolidation of theoretical lecture material. They are used for the purpose of connecting theory with practice, arming students with mathematical methods of research, forming skills in using basic methods of solving typical mathematical problems; formation of the ability to observe, explain and predict phenomena, process the results of experiments and draw conclusions.

Independent work

Involves independent study of individual course topics followed by their analysis with the aim of learning to think independently, practically analyze and use the mastered material.

Practical teaching methods are aimed at achieving the final stage of the learning process. They contribute to the formation of abilities and skills, the logical completion of a link of the cognitive process in relation to a specific section, topic.

Program of educational discipline

Topics of lectures

Topic 1. Indefinite integral

Concept of primitive function and indefinite integral. Basic properties of the indefinite integral. Table of basic integrals. The simplest methods of integration. Integration methods. Integrals of some functions having a quadratic trinomial. The concept of a rational fraction. Decomposition of a proper rational fraction into the sum of the simplest. Integration of a rational fraction. Integration of trigonometric functions. Integration of irrational functions.

Topic 2. The definite integral and its application.

The definite integral. Classes of integrable functions. Properties of the definite integral. Integral with variable upper bound. Newton-Leibnitz formula. Integration by parts and replacement of the variable in the definite integral. Integration of even and odd functions over a symmetric interval. Polar coordinate system. Calculation of areas of flat figures. The length of the arc. Parametric equations of the curve. Calculation of the length of the arc of the curve. Volume of bodies of rotation. Improper integrals. Main properties. Signs of convergence.

Topic 3. Linear differential equations.

Differential equations: basic definitions. Differential equations of the first order. Integrating types of differential equations of the first order: with separable variables, linear. General theory of linear differential equations. Linear homogeneous differential equations (LODR). Properties of LODR solutions. Linear dependence of functions. Vronsky's determinant. The fundamental system of LODR solutions. Theorem on the structure of the general solution of LODR. LODR with fixed coefficients. Theorem on the structure of the general solution of the LNDR. LNDR of the second order with constant coefficients and a special right-hand side. Method of variation of arbitrary constants.

Topic 4. Rows

The concept of a number series, its properties. A convergence sign is necessary. Sufficient signs of convergence of numerical series with positive terms: signs of comparison, D'Alembert's sign, Cauchy's radical and integral signs. Number series with arbitrary terms. Conditional and absolute convergence. Leibniz's sign. Functional series. Area of convergence. Uniform and correct convergence of functional series. Properties of uniformly convergent series. Power series. Abel's theorem. Radius and interval of convergence of power series. Taylor and McLaren series. McLaren series of some elementary functions. Approximate calculations of integrals, integration of differential equations using series.

Topics of practical classes

Topic 1. Indefinite integral



Table of integrals. The simplest methods of integration. Invariance of integration formulas. Integration by parts. Integrals of some functions having a quadratic trinomial. Integration of rational functions. Integration of trigonometric and irrational functions.

Topic 2. The definite integral and its application.

Newton-Leibnitz formula. Integration by parts and replacement of the variable in the definite integral. Calculation of areas of flat figures. Calculation of the length of the arc of the curve. Volume of bodies of rotation. Investigation of the convergence of improper integrals of the first kind.

Topic 3. Linear differential equations.

Differential equations of the first order: with divisible variables, linear. Linear homogeneous differential equations (LODR) with constant coefficients. Linear inhomogeneous differential equations (LNDR) of the second order with constant coefficients and a special right-hand side.

Topic 4. Rows

Study of the convergence of numerical series using the necessary sign of convergence. Sufficient signs of convergence of series with positive terms. Number series with arbitrary terms. Conditional and absolute convergence. Leibniz's sign. Power series. Radius, interval, area of convergence. Decomposition of the function in the Taylor series, McLaren. Application to approximate calculations of integrals, integration of differential equations.

Topics of laboratory works

Laboratory work within the discipline is not provided.

Independent work

Independent work in the discipline includes studying lecture material, preparing for practical classes, independent study of topics and issues that are not taught in lecture classes, as well as performing a calculation task on the topic "Borders. Continuity of function. Technique of differentiation" according to the individual option for each student. The results of calculations are drawn up in a written report.

Literature and educational materials

Basic literature:

- 1 Linear algebra [Text]: teaching method. manual / O.O. Naboka; gift. O. O. Naboka; NTU "KhPI". - Kharkiv: NTU "KhPI", 2020. - 64 p.
2. Indefinite and definite integral: a teaching and methodical guide for the course of higher mathematics for students. and teachers of all specialties. / Pershina Y.I., Prishchenko O.P., Cheremskaya N.V., Chernogor T.T. - Kharkiv: NTU "KhPI", 2021. - 106p.
3. Methodical instructions for practical classes on the topic "Borders. Continuity of a function" from the course "Higher mathematics" for students of technical specialties. all forms of education and teachers: method. order to practice classes / Chikina N.O., Antonova I.V. - Kharkiv: NTU "KhPI", 2021. - 36 p.
4. Oleksenko V.M. Limits and continuity of functions: method. order from the course "Higher Mathematics" for students. Eng. special / V.M. Oleksenko. - Kharkiv: NTU "KhPI", 2021. - 24 p.

Evaluation system

Criteria for evaluating student success, distribution of points
100% of the final grade consists of assessment results in the form of an exam (20%) and ongoing assessment (80%).

Exam: written task (1 theory question + solving three problems) and oral report. Current assessment: 4 control papers, 2 independent papers and a calculation task.

Rating scale

Total points	National assessment	ECT S
90–100	Perfectly	A
82–89	Fine	B
75–81	Fine	C
64–74	Satisfactorily	D
60–63	Satisfactorily	E
35–59	Unsatisfactory (requires further study)	FX
1–34	Unsatisfactorily (re-study required)	F

Norms of academic ethics and policy of the course

The student must adhere to the "Code of Ethics of Academic Relations and Integrity of NTU "KhPI": show discipline, education, benevolence, honesty, responsibility. Conflict situations should be openly discussed in study groups with the teacher, and if it is impossible to resolve the conflict, it should be brought to the attention of the employees of the institute's directorate.

Regulatory and legal support for the implementation of the principles of academic integrity of NTU "KhPI" is posted on the website: <http://blogs.kpi.kharkov.ua/v2/nv/akademichna-dobrochesnist/>



Coordination
Syllabus agreed

Date of approval, signature

Head of Department
Denis MYROSHNICHENKO

Date of approval, signature

Guarantor OP
Iryna SINKEVYCH

