

SYLLABUS OF THE ACADEMIC DISCIPLINE "Higher mathematics"

Academic degree	Bachelor
Academic program	Electric Power Engineering, Electrical Engineering and Electromechanics
Period of study	1st & 2nd semester
Language of study	English
Department	Higher Mathematics




Distance courses

- [Linear and Vector Algebra & Analytic Geometry](https://do.nmu.org.ua/course/view.php?id=3382) (<https://do.nmu.org.ua/course/view.php?id=3382>)
- [Differentiation of a Function](https://do.nmu.org.ua/course/view.php?id=2634) (<https://do.nmu.org.ua/course/view.php?id=2634>);
- [Indefinite integral \(En\) - Babets D.V.](https://do.nmu.org.ua/course/view.php?id=2682) (<https://do.nmu.org.ua/course/view.php?id=2682>);
- [Definite integral \(Babets D.V.\)](https://do.nmu.org.ua/course/view.php?id=3073) (<https://do.nmu.org.ua/course/view.php?id=3073>);
- [Differential Equations \(Babets D.V.\)](https://do.nmu.org.ua/course/view.php?id=3450) (<https://do.nmu.org.ua/course/view.php?id=3450>);

Consultations: 12:55 - 14:15, every Thursday (except holidays), room 5/33

Information about the teacher:

	<p>Dmytro Babets</p>	<p>Cand. of Technical Sciences, Professor of the department of Higher Mathematics</p> <p>Personal page: https://sites.google.com/view/personaliyivm/%D0%BF%D1%80%D0%BE%D1%84%D0%B5%D1%81%D0%BE%D1%80-%D0%B1%D0%B0%D0%B1%D0%B5%D1%86%D1%8C-%D0%B4-%D0%B2</p> <p>Email: Babets.d.v@nmu.one</p>
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1. Annotation to the course

«Neglect of mathematics work injury to all knowledge, since he who is ignorant of it cannot know the other sciences or things of this world»

Roger Bacon

Mathematics is a fundamental science, the methods of which are used in many natural sciences. Without knowledge of the basics of mathematics, it is impossible to study physics and chemistry. Mathematics as a science is the basis

of engineering, where it is necessary to make calculations on the characteristics of materials, parameters of machines and mechanisms, as well to assess the strength of engineering units.

Mathematics operates with abstract interrelations, but entering the field of any science, it is immediately embodied in the description, modeling and prediction of very specific and real natural processes.

For example, in order not to conduct many expensive and dangerous experiments, we can describe the system or process mathematically, and this allows us to predict the state of the object under the influence of various factors, assess the criticality of this state, develop technical and management decisions.

Here are the words of the great Sophia Kovalevskaya: "Among all the sciences that open the way for mankind to learn the laws of nature, the most powerful, the greatest science is mathematics."

2. The purpose and objectives of the discipline

The purpose of course – formation of competencies for the use of mathematical knowledge in the training of bachelors in the specialty 141 «Power engineering, electrical engineering and electromechanics».

Course objectives:

- teaching the principles of using linear algebra to solve systems of linear equations;
- covering vector algebra and analytical geometry to solve problems of natural science;
- providing the principles of using mathematical analysis, differential and integral calculus.
- teaching algorithms for solving technical problems based on the construction and solution of differential equations.

3. Learning outcomes:

- Know the basics and principles of linear and vector algebra, analytical geometry, differential and integral calculus.
- Be able to use a mathematical apparatus for objective analysis of processes in electromechanical equipment.
- Know the principles of solving technical problems based on mathematical analysis, construction and solution of differential equations.

4. The structure of the course

LECTURES
1 Linear and vector algebra
Linear algebra. Matrices. Determinants.
Systems of linear algebraic equations.
Vector algebra. General concepts of vector algebra. Product of vectors and their application.
2 Analytical geometry
Plane in space.
Straight line in space.
Mutual placement of the plane and the line in space.
Straight line on the plane
Second order curves.
The concept of the polar coordinate system.
3 Complex numbers
Complex numbers and operations on them
Elementary functions of a complex variable
4 Basic concepts of Calculus
Functions of one variable. Limits. Continuity of a function.
Derivative of a function.
Differentiation of a complex function, inverse function. Logarithmic differentiation.
The application of derivatives. Extrema values.
Full investigation of a function. Curve sketching.
Differential. Differential invariance.
5 Integral calculus of a function of one variable
Indefinite integral.
Basic methods of integration. Integration by substitution. Integration by parts.
Definite integral.
Geometrical & physical applications of definite integrals.
Improper integrals.
6 Integral and differential calculus of a function of many variables
Functions of many variables. Partial derivatives. Extreme.
Multiple and line integrals and their applications
7 Ordinary differential equations
Ordinary differential equations
Cauchy problem. Equations with separable variables. Homogeneous equations. Linear equations and Bernoulli equations.
Higher order differential equations. The order reduction.
Linear DE of higher order.
Systems of linear differential equations with constant coefficients.
PRACTICAL TRAINING
1 Linear and vector algebra
Linear algebra. Matrices. Determinants.
Systems of linear algebraic equations.

Vector algebra. General concepts of vector algebra. Product of vectors and their application.
Linear algebra. Matrices. Determinants.
2 Analytical geometry
Plane & Straight line in 3D.
Mutual placement of the plane and the line in 3D.
Straight line in the plane (2D case)
Second order curves.
The concept of the polar coordinate system.
3 Complex numbers
Complex numbers and operations on them
Elementary functions of a complex variable
4 Basic concepts of Calculus
Functions of one variable. Limits. Continuity of a function.
Differentiation of a complex function, inverse function. Logarithmic differentiation.
The application of derivatives. Extrema values.
Full investigation of a function. Curve sketching.
5 Integral calculus of a function of one variable
Indefinite integral.
Basic methods of integration. Integration by substitution. Integration by parts.
Definite integral.
Geometrical & physical applications of definite integrals.
Improper integrals.
6 Integral and differential calculus of a function of many variables
Functions of many variables. Partial derivatives. Extreme.
Multiple and line integrals and their applications
7 Ordinary differential equations
Ordinary differential equations
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Higher order differential equations. The order reduction.
Linear equations of higher order
Systems of linear differential equations with constant coefficients

5. TOOLS, EQUIPMENT, AND SOFTWARE

Technical teaching aids.

A Lenovo G500 laptop and a Nec V260G projector are used to teach lectures in the classroom. The mixed form of training uses the MOODLE distance platform, the MS Teams corporate platform, and the Zoom video conferencing program.

MS Excel packages and online resources:

<https://www.desmos.com/calculator?lang=en>;

<https://www.geogebra.org/3d> are used during the practical classes.

6. KNOWLEDGE PROGRESS TESTING

Certification of student achievement is accomplished through transparent procedures based on objective criteria in accordance with the University Regulations “On Evaluation of Higher Education Applicants' Learning Outcomes”.

The level of competencies achieved in relation to the expectations, identified during the control activities, reflects the real result of the student's study of the discipline.

6.1. GRADING SCALES:

Assessment of academic achievement of students of the Dnipro University of Technology is carried out based on a rating (100-point) and institutional grading scales. The latter is necessary (in the official absence of a national scale) to convert (transfer) grades for mobile students.

The scales of assessment of learning outcomes of the NTUDP students

Rating	Institutional
90 ... 100	Excellent
74 ... 89	Good
60 ... 73	Satisfactory
0 ... 59	Failed

6.2. DIAGNOSTIC TOOLS AND EVALUATION PROCEDURES

The content of diagnostic tools is aimed at controlling the level of knowledge, skills, communication, autonomy, and responsibility of the student according to the requirements of the National Qualifications Framework (NQF) up to the 6th qualification level during the demonstration of the learning outcomes regulated by the work program.

During the control activities, the student should perform tasks focused solely on the demonstration of disciplinary learning outcomes (Section 2).

Diagnostic tools provided to students at the control activities in the form of tasks for the intermediate and final knowledge progress testing are formed by specifying the initial data and a way of demonstrating disciplinary learning outcomes.

Diagnostic tools (control tasks) for the intermediate and final knowledge progress testing are approved by the appropriate department.

Type of diagnostic tools and procedures for evaluating the intermediate and final knowledge progress testing are given below.

Diagnostic and assessment procedures

INTERMEDIATE CONTROL			FINAL ASSESSMENT	
training sessions	diagnostic tools	procedures	diagnostic tools	procedures
lectures	control tasks for each topic	task during lectures	comprehensive reference work (CCW)	determining the average results of intermediate controls; CCW performance during the examination at the request of the student
practical	control tasks for each topic	tasks during practical classes		
	or individual task	tasks during independent work		

During the intermediate control, the lectures are evaluated by determining the quality of the performance of the control specific tasks. Practical classes are assessed by the quality of the control or individual task.

If the content of a particular type of teaching activity is subordinated to several descriptors, then the integral value of the assessment may be determined by the weighting

coefficients set by the lecturer.

Provided that the level of results of the intermediate controls of all types of training at least 60 points, the final control can be carried out without the student's immediate participation by determining the weighted average value of the obtained grades.

Regardless of the results of the intermediate control, every student during the final knowledge progress testing has the right to perform the CDF, which contains tasks covering key disciplinary learning outcomes.

The number of specific tasks of the CDF should be consistent with the allotted time for completion. The number of CDF options should ensure that the task is individualized.

The value of the mark for the implementation of the CDF is determined by the average evaluation of the components (specific tasks) and is final.

The integral value of the CDF performance assessment can be determined by taking into account the weighting factors established by the department for each NLC descriptor.

7. Course policy

7.1. Academic Integrity Policy. Academic integrity of students is an important condition for mastering the results of training in the discipline and obtaining a satisfactory grade on the current and final tests. Academic integrity is based on condemnation of the practices of copying (writing with external sources other than those allowed for use), plagiarism (reproduction of published texts by other authors without indication of authorship), fabrication (fabrication of data or facts used in the educational process). The policy on academic integrity is regulated by the Regulation "Regulations on the system of prevention and detection of plagiarism at the Dnipro University of Technology (http://www.nmu.org.ua/ua/content/activity/us_documents/System_of_prevention_and_detection_of_plagiarism.pdf.)

In case of violation of academic integrity by a student (copying, plagiarism, fabrication), the work is evaluated unsatisfactorily and must be repeated. The teacher reserves the right to change the topic of the task.

7.2. Communication policy.

Students must have activated university mail.

It is the student's responsibility to check the mailbox at Office365 once a week (every Sunday).

During the weeks of independent work, it is the student's responsibility to work with the distance course "Higher Mathematics" (www.do.nmu.org.ua)

All written questions to teachers regarding the course should be sent to the university e-mail.

7.3. Reassembly policy.

Works that are submitted in violation of deadlines without good reason are evaluated at a lower grade. Relocation takes place with the permission of the dean's office if there are good reasons (for example, sick leave).

7.4. Attending classes.

Full-time students are required to attend classes. Good reasons for not attending classes are illness, participation in university events, business trips, which must be confirmed by documents in case of prolonged (two weeks) absence. The student must inform the teacher either in person or through the headmaster about the absence from class and the reasons for absence. If a student is ill, we recommend staying home and studying with a distance platform. Students whose health is unsatisfactory and may affect the health of other students will be encouraged to leave the class (such absence will be considered an absence due to illness).

Practical classes are not repeated; these assessments cannot be obtained during the consultation. For objective reasons (for example, international mobility), learning can take place remotely - online, in agreement with the teacher.

7.5 Evaluation Appeal Policy. If the student does not agree with the assessment of his knowledge, he may appeal the assessment made by the teacher in the prescribed manner.

7.6. Bonuses. Students who regularly attended lectures (have no more than two passes without good reason) and have a written syllabus of lectures receive an additional 2 points to the results of the assessment to the final grade.

7.7. Participation in the survey. At the end of the course and before the session, students will be asked to fill out anonymously questionnaires (Microsoft Forms Office 365), which will be sent to your university mailboxes. Completing the questionnaires is an important component of your learning activity, which will allow you to assess the effectiveness of the teaching methods used and take into account your suggestions for improving the content of the discipline "Higher Mathematics".

8. RECOMMENDED BIBLIOGRAPHY

8.1 Basic

1. Derivatives and their application = Похідні та їх застосування: Textbook (англійською мовою) / O. Sdvyzhkova, S. Tymchenko, D. Babets, Yu. Olevska, D. Klymenko, P. Shcherbakov; / The Ministry of Education and Science of Ukraine, Dnipro University of Technology. – Dnipro: «Dniprotech», 2020. –70 с.
2. Indefite Integral (англійською мовою) [Текст]: навч. посіб. для студ. вищ. навч. закл /Бабець Д.В, Сдвижкова О.О.; Тимченко С.Є.; Щербаків П.М/ М-во освіти і науки України, Нац. техн.. ун-т «Дніпровська політехніка». – Дніпро: НТУ «ДП», 2018. – 65 с.
3. Звичайні диференційні рівняння (англійською мовою) [Текст]: навч. посіб. для студ. гірн. спец. вищ. навч. закл. / Е.А.Сдвижкова, Л.І. Коротка, Д.В.Бабець, Ю.Б. Олевська ; М-во освіти і науки України, Нац. гірн. ун-т. – [Нове вид.]. – Д. : НГУ, 2015. – 60 с. – ISBN 978-966-350-587-9.
4. K Weltner, W. J. Weber, J. Grosjean P. Schuster: Mathematics for Physicists and Engineers. Springer, 2009
5. Є.С. Сінайський, Л.В. Новікова, Л.І. Заславська. Вища математика (частина 1): навч. посібник. – Дніпропетровськ: НГУ, 2004. – 389 с.
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8. Вища математика в прикладах і задачах: у 2 т. Т.2: Диференціальне числення функцій багатьох змінних. Диференціальні рівняння та ряди: навч. посібник / Л.В.Курпа, Н.О.Кирилова, Г.Б.Лінник [та ін.]; за ред. Л.В.Курпи. – Харків: НТУ «ХП», 2009. – 432с.
9. Вища математика. Розв’язання задач та варіанти типових розрахунків. Т.1.: Навч. Посібник / За ред. Л.В.Курпа. — Харків: НТУ “ХП”, 2002 – 316 с.

8.2 Additional

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11. Застосування методів диференціального та інтегрального числення до розв'язання задач технічного змісту. Методичні вказівки для самостійної роботи студентів / Л.Й. Бойко, В.І. Павліщев. – Дніпропетровськ: НГУ, 2012. – 46с.

9. INFORMATION RESOURCES

1. Literature on the website of the Department of Higher Mathematics:
<https://vm.nmu.org.ua/lib.html>;
2. **Linear and Vector Algebra & Analytic Geometry**
(<https://do.nmu.org.ua/course/view.php?id=3382>)
3. **Differentiation of a Function** (<https://do.nmu.org.ua/course/view.php?id=2634>);
4. **Indefinite integral (En) - Babets D.V.**
(<https://do.nmu.org.ua/course/view.php?id=2682>);
5. **Definite integral (Babets D.V.)** (<https://do.nmu.org.ua/course/view.php?id=3073>);
6. **Differential Equations (Babets D.V.)**
(<https://do.nmu.org.ua/course/view.php?id=3450>);