SYLLABUS OF THE ACADEMIC DISCIPLINE
"Higher mathematics"

Academic degree	Bachelor
Academic program	192 Construction and Civil Engeneering
Тривалість викладання	1-4 quarters
Заняття:	2020 -201ed.year
Мова викладання	English
Кафедра, що викладає	Higher mathematics

Distance courses
https://do.nmu.org.ua/course/view.php?id=3382
https://do.nmu.org.ua/enrol/index.php?id=3073
https://do.nmu.org.ua/course/view.php?id=2682
https://do.nmu.org.ua/course/view.php?id=3450

Consultations: 11.20-13.00, every Monday (except holidays), room 5/25

Teacher information:

 	**Prof.Olena Sdvyzhkova (Lectures), Prof.** **Dmytro Babets (Practical training)**	Doctor of Technical Sciences, Professor Cand. of Technical Sciences, Professor
	Personal pages	https://sites.google.com/view/personaliyivm/%D0%B7%D0%B0%D0%B2-%D0%BA%D0%B0%D1%84%D0%B5%D0%B4%D1%80%D0%B8-%D0%BF%D1%80%D0%BE%D1%84%D0%B5%D1%81%D0%BE%D1%80-%D1%81%D0%B4%D0%B2%D0%B8%D0%B6%D0%BA%D0%BE%D0%B2%D0%B0-%D0%BE-%D0%BE?fbclid=IwAR3Fsn_W_VhD-hz03urbPudiEBZ8TW4Ce7qvgR6S8OtzZYf065u29Bu5_MI 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
	E-mail:	sdvyzhkova**.o.o@nmu.one**, babets**.d.v@nmu.one**

1. Annotation to the course

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, we cannot carry out a large number of valuable and dangerous experiments on the interaction of the structure foundation with the soil, but we can describe the behavior of soils mathematically, based on the basic relations of mechanics and resistance of materials, and this allows predicting various factors, assess the criticality of this condition, 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 the discipline "Higher Mathematics" is the formation of competencies for the use of mathematical knowledge in the bachelors training in the specialty 192 Construction and Civil Engineering.

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:

- understanding the principles of using matrix algebra in technical problems and knowing the basics of solving systems of linear equations;
- knowing the principles of using vector algebra and analytical geometry in science problems;
- knowing the basics of mathematical analysis, differential and integral calculus;

- knowing the types and principles of solving differential equations, being able to apply them while technical problem solving.

4. The structure of the discipline

Names of topics	Total	Number of hours				
		у тому числі				
		Lecture	Pract.	Lab.	Individ. work	Self-training
1	2	3	4	5	6	7
Module 1 Liner and Vector algebra. Analytical geometry						
Linear algebra. Matrices. Determinants.	13	2	2			9
Systems of linear algebraic equations.	13	2	2			9
Vector algebra. General concepts of vector algebra. Product of vectors and their application.	17	4	4			9
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.	17	4	4			9
Total	**60**	**12**	**12**	**0**	**0**	**36**
Module 2 Differential Calculus.						
Functions of one variable. Limits. Continuity of a function. Derivative of a function.	13	2	2			9
The application of derivatives. Extrema values. Curve sketching	21	6	6			9
Differential. Differential invariance	17	4	4			9
Functions of many variables. Partial derivatives. Extrema values.	13	2	2			9
Total	**64**	**14**	**14**			**36**
Module 3 Integral calculus						
Indefinite integral. Basic methods of integration. Integration by substitution. Integration by parts.	22	6	6			10
Definite integral.	18	4	4			10
Geometric applications of definite integrals.	18	4	4			10
Physical applications of definite integrals.	14	2	2			10

Integrals with infinite boundaries.						
Total	**72**	**16**	**16**			**40**
Module 4 Ordinary differential equations						
Cauchy problem. Equations with separable variables. Homogeneous equations. Linear equations and Bernoulli equations.	**24**	**6**	**6**			**12**
Higher order differential equations. The order reduction.	**16**	**2**	**2**			**12**
Linear equations of higher orders.	**20**	**4**	**4**			**12**
Systems of linear differential equations with constant coefficients	**13**	**2**	**2**			**9**
Total	**73**	**14**	**14**			**45**
Total+16hours of testing	**269 +16 = 285**	**18**	**18**			

5 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.

5.1 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

Discipline credits are scored if the student has a final grade of at least 60 points. A lower grade is considered to be an academic debt that is subject to liquidation in accordance with the Regulations on the Organization of the Educational Process of NTUDP.

5.2 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 7th 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

<table>
<tr><th colspan="3">INTERMEDIATE CONTROL</th><th colspan="2">FINAL ASSESSMENT</th></tr>
<tr><th>training sessions</th><th>diagnostic tools</th><th>procedures</th><th>diagnostic tools</th><th>procedures</th></tr>
<tr><td>lectures</td><td>control tasks for each topic</td><td>task during lectures</td><td rowspan="3">comprehensive reference work (CCW)</td><td rowspan="3">determining the average results of intermediate controls;

CCW performance during the examination at the request of the student</td></tr>
<tr><td rowspan="2">practical</td><td>control tasks for each topic</td><td>tasks during practical classes</td></tr>
<tr><td>or individual task</td><td>tasks during independent work</td></tr>
</table>

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.

5.3 EVALUATION CRITERIA

The actual student learning outcomes are identified and measured against what is expected during the control activities using criteria that describe the student's actions to demonstrate the achievement of the learning outcomes.

To evaluate the performance of the control tasks during the intermediate control of lectures and practicals the assimilation factor is used as a criterion, which automatically adapts the indicator to the rating scale:

$$O_i = 100\ a / m,$$

where a - number of correct answers or significant operations performed according to the solution standard; m - the total number of questions or substantial operations of the standard.

Individual tasks and complex control works are expertly evaluated using criteria that characterize the ratio of competency requirements and evaluation indicators to a rating scale.

6. Course policy

6.1. 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.

6**.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.

6.3. 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).

6.4. 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.

6.5 **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.

6.6. **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.

6.7. **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".

7.Ресурси і література

1. Differential Equations : 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.
2. Indefite Integral: навч. посіб. для студ. вищ. навч. закл /Бабець Д.В, Сдвижкова О.О.; Тимченко С.Є.; Щербаков П.М/ М-во освіти і науки України, Нац. техн.. ун-т «Дніпровська політехніка». – Дніпро: НТУ «ДП», 2018. – 65 с.
3. Вища математика. Частина 1: навч. посіб. для студ.гірн. спец. вищ. навч. закл. / Є.С. Сінайський, Л.В. Новікова, Л.І. Заславська Дніпропетровськ. М-во освіти і науки України, Нац. гірн. ун-т. –Д. : НГУ, 2013. – 399 с.
4. Функции. Предел. Производная и ее применение. Методические указания по элементарной математике слушателям подготовительного отделения для иностранных граждан / Д.В. Бабец, Е.А. Сдвижкова, С.Е. Тимченко, С.Н. Подольская, З.И. Бондаренко, Д.В. Клименко. – Д.: Национальный горный университет», 2013. – 126 с.
5. K.F. Riley, M.P. Hobson and S. J. Bence: Mathematical Methods for Physics and Engineering. – Cambridge University Press, 2006
6. K Weltner, W. J. Weber, J. Grosjean P. Schuster: Mathematics for Physicists and Engineers. – Springer, 2009