



# Mathematical analysis. Part 1.

## Differential calculus

### Syllabus

Requisites of the Course	
<b>Level of higher education</b>	First (bachelor's)
<b>Field of Study</b>	12 Informational technologies
<b>Specialty</b>	121 Software Engineering
<b>Educational program</b>	Computer Systems Software Engineering
<b>Status of the discipline</b>	Normative
<b>Form of study</b>	full-time
<b>Year of study, semester</b>	1st year, autumn semester
<b>Scope of the discipline</b>	5 credits, 150 hours (36 hours lectures, 36 hours practical, 78 hours self-study)
<b>Semester control/ control measures</b>	Exam / modular control work, calculation and graphic work
<b>Class schedule</b>	<a href="http://rozklad.kpi.ua">http://rozklad.kpi.ua</a>
<b>Language of instruction</b>	English
<b>Information about the course instructors</b>	<p><b>Lecturer:</b> Associate professor, PhD, Iryna Ihorivna Golichenko, <a href="mailto:idubovetska@gmail.com">idubovetska@gmail.com</a> Senior lecturer Iryna Petrivna Blazhievskaya, PhD, <a href="mailto:i.blazhievskaya@gmail.com">i.blazhievskaya@gmail.com</a></p> <p><b>Practical:</b> Senior lecturer, Ph.D, Olena Oleksandrivna Vaneeva, <a href="mailto:vaneeva@gmail.com">vaneeva@gmail.com</a> Associate Professor, Ph.D. N. Iryna Ihorivna Golichenko, <a href="mailto:idubovetska@gmail.com">idubovetska@gmail.com</a> Assistant, Skorobagach Aunty Bohdanivna, <a href="mailto:tetianaskorobohach@gmail.com">tetianaskorobohach@gmail.com</a></p>
<b>Placement of the course</b>	<a href="https://campus.kpi.ua">https://campus.kpi.ua</a> <a href="https://do.ipk.kpi.ua/course/view.php?id=5959">https://do.ipk.kpi.ua/course/view.php?id=5959</a>

## Outline of the Course

### 1. Description of the educational discipline, its purpose, subject of study and results teaching

<p><b>Description disciplines</b></p>	<p>In accordance to educational plan educational discipline "Mathematical analysis. Part 1" (GM 10.1) belongs to the cycle of mathematical, natural scientific training and is of dominant importance in the training of a specialist. He is necessary for successful assimilation special discipline Present credit module is based on students' knowledge acquired during study mathematics in high school. Discipline "Mathematical analysis. Part 2" is one of the fundamental general education disciplines that make up theoretical basis of training of engineers and programmers. Knowledge and skills, received a student under time study given educational disciplines, are used in further at studies many the following discipline professional preparation a specialist with basic and full highereducation At passing given disciplines students get acquainted with: with introduction in mathematical analysis, functions one variable (region definition, range of values, types and methods of assignment of functions, basic characteristics of functions, methods of research and construction of graphs, basic elementary functions and their graphs); basics of differential calculus functions of one variable (limit of a numerical sequence, limit of a function, the first and second significant limits and their consequences are equivalently infinitesimal functions and infinitely large functions, continuity, convexity of the function, asymptotes, classification points gap, tangent and normal to curve, derivative and differential functions, asymptotes graphics functions, extreme functions, rule Hospital , construction graphs functions). They are studying functions many variables.</p>
<p><b>Objectives disciplines</b></p>	<p>the purpose educational disciplines is:</p> <ul style="list-style-type: none"> <li>● formation in acquirers education logical thinking, development their intelligence and abilities;</li> <li>● formation abilities to necessary intuition and erudition in questions application of mathematics, education of students in applied mathematicscultures;</li> <li>● formation of abilities to independently use and study literature with mathematicians, develop flexibility thinking, creative independence and action</li> </ul>
<p><b>Educational subject disciplines</b></p>	<p>general mathematical properties and regularities. Functions one variable, foundations differential calculus functions one variable, differential calculus many variables</p>
<p><b>Competences</b></p>	<p><b>The purpose</b> of the educational discipline is to form students of the followingabilities:</p> <ul style="list-style-type: none"> <li>● ability to abstract thinking, analysis and synthesis (GC01)</li> <li>● Ability apply knowledge in practical situations (GC02)</li> <li>● Ability to search, process and analyze information from various sources (GC06)</li> <li>● Ability work in team</li> <li>● Ability apply corresponding mathematical, scientific and technical methods, modern information technologies and computer software support, skills in working with computer networks, databases data and Internet resources for engineering solutions tasks</li> <li>● ability detect, put and solve problems</li> <li>● the ability to apply the skills acquired after learning disciplines "Mathematical analysis. Part 1", when studying in generalengineering and special disciplines;</li> <li>● ability use methods mathematical analysis inengineering calculations;</li> </ul>

	<ul style="list-style-type: none"> <li>• The ability to bring the solution of the problem to a practically accepted one of the result - numbers, graphs, accurate qualitative conclusions from using various computing tools for this, tables and directories;</li> <li>• The ability to analyze the results obtained, the ability to generalization, productions objectives and of choice ways her solution, possession culture of thinking.</li> </ul>
<b>Program results teaching</b>	<ul style="list-style-type: none"> <li>• Know and apply corresponding mathematical concept, methods domain, system and object-oriented analysis and mathematical modeling for software development (PRN05)</li> <li>• Apply knowledge and understanding of differential calculus, algebra for solution theoretical and applied engineering tasks</li> <li>• Define and identify technological mathematical models objects at developers in computer environment new ones complex electronic systems and choice optimal solution.</li> <li>• Build graphs basic elementary functions, perform transformation graphs, by schedule functions determine trends process, which she models find the roots polynomials, decompose polynomials with valid coefficients on multipliers, carry out operations over complex numbers in algebraic, in trigonometric and exponential forms, to decompose the wrong fraction in the amount of polynomial and correct fraction;</li> <li>• Find borders numerical sequences and borders functions, compare endlessly are small functions, explore function on continuity, classify breakpoints and construct asymptotes function graph, find derivatives and differentials of functions of one variable, know the applied content of the derivative, apply the differential to approximate calculations, apply differential calculus to research functions and buildings graphs, find borders by rule Hospital ;</li> </ul>

## 2. Prerequisites and post-requisites of the discipline (place in the structural-logical schemes teaching according to the corresponding educational program)

**Prerequisites :** Present credit module is based on knowledge students, acquired at studying the school course mathematicians

**Post-requisites :** Credit module "Mathematical analysis. Part 1" enters to cycle of mathematical, natural and scientific training and has a dominant value in preparation a specialist Present credit module is based on knowledge students, acquired at studies mathematicians by school course, and precedes educational discipline "Mathematical analysis. Part 2".

## 3 . Content of educational discipline

Name sections and topics	Number hours			
	In total	in ago number of		
		Lectures	Practical	Self-study
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
<b>Section 1. Differential calculus functions one variable</b>				
<i>Topic 1.1. Introduction to mathematical analysis</i>	<b>32</b>	<b>12</b>	<b>10</b>	<b>6</b>
<i>Topic 1.2. Differential calculus</i>	<b>36</b>	<b>10</b>	<b>14</b>	<b>6</b>

<i>and its application</i>				
<i>MCW -1</i>	<b>6</b>	<b>-</b>	<b>2</b>	<b>4</b>
<b>Section 2. Differential calculus functions many variables</b>				
<i>Topic 2.1. Functions many variables: basic concepts, function limit, continuity</i>	<b>10</b>	<b>5</b>	<b>3</b>	<b>3</b>
<i>Topic 2.2. Derivatives and differentials functions many variables</i>	<b>10</b>	<b>5</b>	<b>3</b>	<b>3</b>
<i>Topic 2.3. The extremum of the function of two variables</i>	<b>10</b>	<b>4</b>	<b>2</b>	<b>2</b>
<i>MCW -2</i>	<b>6</b>	<b>-</b>	<b>2</b>	<b>4</b>
<i>Calculated graphic work</i>	10	-	-	10
<i>Exam</i>	30		-	30
<i>In total hours</i>	<b>150</b>	<b>36</b>	<b>36</b>	<b>68</b>

#### 4. Educational materials and resource

##### Basic literature

1. Math in technical university: Textbook./ I.V. Alekseeva , V.O. Heidei , O.O. Dykhovychyny , L.B. Fedorova; under the editorship O.I. Klesova ; KPI named after Igor Sikorsky, - Kyiv: KPI named after Igor Sikorskyi, 2018. – Volume 1. - 496 p.  
<http://ela.kpi.ua/handle/123456789/24338>
2. Math in technical university: Textbook./ I.V. Alekseeva , V.O. Heidei , O.O. Dykhovychyny , L.B. Fedorova; under the editorship O.I. Klesova ; KPI named after Igor Sikorsky, - Kyiv: KPI named after Igor Sikorskyi, 2019. - T.2. - 504 p.  
<https://ela.kpi.ua/handle/123456789/30396>
3. Math in technical university: Textbook./ I.V. Alekseeva , V.O. Heidei , O.O. Dykhovychyny , L.B. Fedorova; under the editorship O.I. Klesova ; KPI named after Igor Sikorsky, - Kyiv: KPI named after Igor Sikorskyi, 2021. - Volume 3. - 456 p.  
<https://ela.kpi.ua/handle/123456789/39003>
4. Math in modern technical university Practicum Part 2. Differential and integral calculus of functions of one variable [Electronic resource]: study guide for students of higher educational institutions / I.V. Alekseeva , V.O. Gaidei , O. O. Dykhovychyny [and others]. – Electronic text data (1 file: 3.67 MB). – Kyiv : NTUU "KPI", 2015. - 249 p.  
<https://ela.kpi.ua/handle/123456789/16620>
5. Differential and integral calculus functions several variables Derentialequation. Practicum for students technical specialties / Compilers: Alekseeva I.V., come on V.O., Spiritual O.O., Fedorova LB, - Kyiv: KPI named after Igor Sikorsky, 2016.- 188 pages.  
<http://matan.kpi.ua/public/files/2016/%D0%9F%D1%80%D0%B0%D0%BA%D1%82%D0%B8%D0%BA%D1%83%D0%BC%D0%92%D0%9C2-2016.pdf>

### **Supporting literature**

6. Differential and integral calculus of functions of one variable. Collection of tasks to typical calculation work for first-year students of technical faculties. / Composer: L. B. Fedorova, N. R. Konovalova, I. V. Alekseeva etc. — K.: IVC "Polytechnic", 2001.
7. Dubovik V. P. Higher mathematics / V. P. Dubovik, I. I. Yuryk. — Kyiv: Ignatex-Ukraine, 2013. — 648 p
8. Differential and integral calculus functions one variable Practicum for students AND course technical specialties / Compilers: Alekseeva I.V., come on V.O., O Dykhovychny, L.B. Fedorova, - Kyiv: KPI named after Igor Sikorskyi, 2013.  
<http://matan.kpi.ua/public/files/PraktykumMA1.pdf>
9. Dubovyk IN. P. Higher math. Collection tasks: teach \_ manual \_ / IN. P. Dubovyk, AND. AND. Yurik - K.: A.S.K., 2005. - 648 p.
10. Math in technical university : Practicum : IN 4th h / AND. IN. Alekseeva , IN. AT. Heidei , AT. AT. Dykhovychny , L. B. Fedorova. — Kyiv : NTUU "KPI", 2014. — 752 p.
11. Adams R. A. Calculus : Complete course / R. A. Adams , C. Essex . — Toronto : PearsonCanada , 2010. — 1076 pp .
11. Zill D. G. Advanced engineering mathematics / D. G. Zill , W. S. Wright . — Burlington : Jones and Bartlett Learning , 2017. — 1004 pp .
13. Zill D. G. Calculus : Early transcendentals / D. G. Zill , W. S. Wright . — Sudbury : Jones and Bartlett publishers , 2011. — 994 pp .

### **Information resources**

#### **Remote courses:**

1. Mathematics for engineers and economists. Differential calculus of functions one variable  
Course for bachelors of technical and economic specialties. Lectures, practice, video lectures  
Alekseeva , V.O. Gaidei , O.O. Dykhovychnyi , L.B. Fedorova, N.R. Konovalova, Dudko A.F.  
<http://moodle.ipk.kpi.ua/moodle/course/view.php?id=960>
2. Math for engineers and economists Integral calculus functions one variable Course for bachelors technical and economic specialties lectures, practice, video lectures . I.V. Alekseeva , V.O. Gaidei , O.O. Dykhovychnyi , L.B. Fedorova, Konovalova N.R., Dudko A.F., Moskvychova K.K.  
<http://moodle.ipk.kpi.ua/moodle/course/view.php?id=1249>

## **Educational content**

### **5. Methodology**

#### **Lectures**

No s/p	Name topics lectures and list basic questions (list didactic means, link on literature and task on Self-study)
<b>1</b>	<b>Introduction. Mathematical shorthand: using symbols mathematical logic for abbreviated recording mathematical statements Plurals and</b>

	<p>operations over them Numerical plural Limited numerical pluralsconcept exact upper and lower limits plural</p> <p><i>Task on Self-study: Concept functions. The main ones characteristics behavior functions.</i></p> <p><i>Recommended literature: [1], 1.1-1.4; [2], 5.</i></p>
2	<p>Concept numerical sequence and her borders Properties convergentsequences. Weierstrass theorem on the existence of a monotone limit sequence The number <math>e</math>.</p> <p><i>Recommended literature: [2], 6.2.</i></p>
3	<p>The limit of a function. Definition of the finite limit of a function at a point by Cauchy and by Heine. One-sided boundaries, conditions for the existence of the boundary of a function. Endlessly are small and endlessly big functions. Comparison N. m. and n.v. _ functions.</p> <p><i>Recommended literature: [2], 6.1, 6.3.</i></p>
4	<p>The first significant border and her consequences. The second significant border and herconsequences. Table equivalent endlessly small functions.</p> <p><i>Recommended literature: [2], 6.3.</i></p>
5	<p>Continuity functions in points and on segment Definition continuityfunctions. The concept of breakpoints of a function and their classification. The main ones theorems about continuous on segment functions.</p> <p><i>Recommended literature: [2], 6.4.</i></p>
6	<p>derivative functions. Definition derivative, her geometric and physical content.Rules calculation derivative Derivatives basic elementary functions.</p> <p><i>Recommended literature: [2], 7.1.</i></p>
7	<p>Methods differentiation derivative complex and inverted functions. Logarithmic differentiation Differentiation functions, given implicitly and parametrically.</p> <p><i>Recommended literature: [2], 7.1.</i></p>
8	<p>Differential function. Derivatives and differentials of higher orders. Concept differential functions and him geometric content. Properties differential and using in relatives calculations. Definition derivatives and differentials higher orders and their properties Formula Leibniz .</p> <p><i>Recommended literature: [2], 7.2.</i></p>
9	<p>The main ones theorems differential calculus. Theorems Farm, Role , Lagrange , Koshi. Rule Bernoulli — Hospital and him usingfor disclosure basic types of uncertainties.</p> <p><i>Recommended literature: [2], 7.3.</i></p>
10	<p>Formula Taylor . Concept polynomial Taylor and him residual member in form Peano . Breeding formulas McLaren for basic elementary functions. Using Taylor's formulas in approximations calculations.</p> <p><i>Recommended literature: [2], 7.4.</i></p>
11	<p>Research functions by help the first derivative Definition monotony functions on segment Necessary and sufficient conditions monotony and constancy functions on segment Definition extreme functions in points Necessary and are sufficient conditions the extremum of the function in points</p> <p><i>Recommended literature: [2], 7.5.</i></p>
12	<p>Definition extreme functions in points Necessary and are sufficient conditionsextreme functions in points</p> <p><i>Recommended literature: [2], 7.5.</i></p>
13	<p>Research functions by help the second derivative Building graphics</p>

	<b>functions. Definition convex functions and points bend Necessary and sufficient conditions convexity function on segment and points bend</b> <i>Recommended literature:</i> [2], 7.5.
14	<b>Asymptotes graphics functions and methods their finding. General scheme research function and construction graphics</b> <i>Recommended literature:</i> [2], 7.5.
15	<b>Concept functions many variables, region definition, value, partial derivatives The border and continuity, differentiability . Differentiation composed and implicit functions.</b> <i>Recommended literature:</i> [2], 8.1, 8.2.
16	<b>Partial differentials of functions of many variables. Full differential. Approximate calculations using the differential. Tangent plane and normal to the surface Taylor's formula . Functions of two variables</b> <i>Recommended literature:</i> [2], 8.2, 8.4.
17	<b>Scalar field, derivative by directly gradient.</b> <i>Recommended literature:</i> [3], 11.1; [2], 8.4.
18	<b>Extremum of functions of many variables . Local and conditionalextrema of a function of two variables .</b> <i>Recommended literature:</i> [2], 8.5.

#### Practical classes

No s/p	Name topics occupation and list basic questions (list didactic means, link on literature and task on Self-study)
1	<b>Plurals and operations with them</b> Task on Self-study: [4], pp. 77-83.
2	<b>The limit of the sequence . Task</b> on Self-study: [4], pp. 84-93.
3	<b>The border functions</b> Task on Self-study: [4], pp. 92-99.
4	<b>The first and friend notable borders and consequences with them</b> Task on Self-study: [4], pp. 100-106.
5	<b>Endlessly are small and endlessly big functions.</b> Task on Self-study: [4], pp. 100-106.
6	<b>Continuous functions. points gap</b> Task on Self-study: [4], pp. 107-114.
7	<b>MCW -1 "Introduction to mathematical analysis"</b>
8	<b>derivative functions. Methods differentiation</b> Task on Self-study: [4], pp. 115-125.
9	<b>Differential functions and him application.</b> Task on Self-study: [4], pp. 126-130.
10	<b>Derivatives and differentials higher orders Rule Bernoulli — Hospital .</b> Task on Self-study: [4], pp. 131-138.
11	<b>Formula Taylor .</b> Task on Self-study: [4], pp. 139-143.
12	<b>Research functions by help the first derivative</b> Task on Self-study: [4], p. 144-149.
13	<b>Research functions by help the second derivative, construction graphs functions.</b> Task on Self-study: [4], pp. 150-158.

14	<b>MCW -2 "Differential calculus functions one variable"</b>
15	<b>Functions many variables Partial derivatives, differentials</b> Task on Self-study: [5], page 45-57.
16	<b>Tangent plane and normal to surface</b> Task on Self-study: [5], page 58-63.
17	<b>Derivative in direction, gradient. Taylor's formula . The extremum of the function of two variables</b> Task on Self-study: [5], pp. 58-63.
18	<b>MCW -3 "Differential calculus functions many variables"</b>

## 6. Self-study

Study discipline includes the following types of self-study work:

- preparation to lectures and practical classes, implementation domestic tasks;
- implementation home control work (test task in remotecourses on the platform Moodle );
- implementation calculation graphic works;
- preparation and implementation modular control works;
- preparation to exam

### Control work

Modular control work consists with three parts:

1. MCW -1. "Introduction to mathematical analysis".
2. MCW -2. "Differential calculus functions one variable".
3. MCW -3. "Differential calculus functions many variables".

Goal modular control works – reveal level assimilation relevantmodules, counting points by credit-modular system modules.

## Policy and CONTROL

### 7. Policy educational disciplines (educational component)

**Recommended methods teaching:** study main and auxiliary literature by subject lectures, solving tasks on practical classes and at performance housework

To a student is recommended lead detailed compendium lectures Important aspect quality assimilation material, working out methods and algorithms solution the main tasks of the discipline are independent work. It includes reading literature, review literature by topic preparation to classes, implementation calculation typicalwork, preparation to MCW and the exam.

#### Academic virtue

The policy and principles of academic integrity are defined in section 3 of the Code honor National technical university of Ukraine "Kyivskyi polytechnic institute named after Igor Sikorsky". More details: <https://kpi.ua/code>

#### Norms ethical behavior

Standards of ethical behavior of students and employees are defined in section 2 of the Code of Honor National technical university of Ukraine "Kyivskyi polytechnic institute name Igor Sikorsky". More details: <https://kpi.ua/code>



## 8. Types of control and rating system for evaluating learning outcomes (RSO)

Distribution educational time by species classes and tasks with disciplines according to with working curriculum

Semester	Educational time		Distribution educational hours				Control activities		
	loans	Acad . hours	Lecture .	Practical .	Lab . do	Self-study + Ex .	MCW	CGW	semester attestation
1	5	150	36	36	-	78	2	1	ex .

Rating student with disciplines consists with points what he receives by

- 1) writing modular control works;
- 2) execution of calculation and graphic work (CGW is divided into several parts, according to topics)
- 3) answer on exams

**The size of the starting scale  $R_C = 50$  points.**

**Size examination scales  $R_E = 50$  points**

**Size scales rated  $R = R_S + R_E = 100$  points**

### *System rating (weight) points and criteria assessment*

#### 1. Modular control work Weight score -30.

The modular control work consists of three parts: MCW -1.

"Introduction to mathematical analysis" - gravimetric mark 10

MCW -2 "Differential calculus of functions of one variable" - weight point 10

MCW -3 "Differential calculus of functions of many variables" - weight point 10

Maximum mark  $10+10+10=30$ .

Criterion assessment ICR : absence on control work – 0 points rating MCW (in points) is equal to the value percent its execution.

When performing < 60% of MCW, it is not counted.

#### 2. Calculated graphic work (CGW).

Gravimetric mark – 20.

Criterion assessment CGW:

Non-fulfillment of CGW - 0 points. The CGW is implemented and protected by the parts that per the content corresponds to the modular one control work. Parts of the CGW are surrendered to writing MCW , and themselves MCW is protection

The CGW assessment (in points) is equal to the value of the percentage (from the maximum number of points 20) her implementation with taking into account result writing of the relevant ICR .

At performance Less 60% CGW she not is counted and must be revised

For untimely (later than a week) submission of CGW, no more is credited 60%.

#### 3. Answer on the exam

Gravimetric score is 50.

Gravimetric mark each task 10.

On exams student performs written examination work ticket consists with 1 theoretical question and 4 practical tasks

Criteria assessment

- "excellent": full answer on all task (not Less 90% necessary information; complete unmistakable solving tasks) 9 – 10 points;
- "good": enough full answer (not Less 75% necessary information) or insignificant inaccuracies 7 – 8 points;
- "satisfactorily": incomplete answer on task (not Less 60%) and is errors and certain deficiencies of 5-6 points;
- "fail": answer not responds conditions to "satisfactorily" (unsatisfactory answer, wrong solution method" 0 – 4 points

The maximum score is  $10 \times 5 = 50$

Encouraging points are accrued

- by proper preparation to practical classes and active work on them;
- for prizes at faculty and university olympiads from higher education mathematicians

Maximum number encouraging points not exceeds 10% (5 points).

### Conditions positive intermediate attestation

is "enrolled" from the first intermediate certification (week 8) to receive it should have not Less, than 50% possible points on moment carrying out calendar control

is "enrolled" from the second intermediate certification (week 14) to receive it must also have on less than 50% possible points at the time of the event calendar control

Redoing the positive final semester certification for the purpose of it increase not is allowed

### Student is allowed to exam,

if him terminal rating not less 30 points at this he should have enrolled modular control works and CGW (at least 60% completed). students, which in the ends educational semester have start rating  $R_s < 20$  points to exam not are allowed and should eliminate debts( add CGW, write MCW ) to the first rearrangement.

Students with rating  $20 \leq R_c < 30$  have possibility to get points to admissions , by implementation admission control work on to the last weeks educational semester

### Table of transfer of R rating from educational disciplines

Table 1

$R = R_c + R_e$	Traditional rating
$95 \leq R \leq 100$	Excellent
$85 \leq R \leq 94$	Very good
$75 \leq R \leq 84$	Good
$65 \leq R \leq 74$	Satisfactorily
$60 \leq R \leq 64$	Sufficient
$30 \leq R \leq 59$	Fail
$R_s < 30$ or not performed others conditions admission to exam	Not admitted

**IN case remote forms teaching in RSO are happening the following changes:**

- Control activities are held remotely from application electronic mail, Telegram , Zoom and educational platforms Moodle , in particular in in the form test control works
- The maximum amount of weight points control measures for semester  $R_S$  is installed on levels 50 points
- admission mark to exam  $RD$  is installed on levels 30 points
- Confirmation of the student's fulfillment of the requirements of current control and conditions of admission to exam must be displayed in the Electronic Campus .
- IN case not receiving a student admission ball, him is provided possibility increase the amount of points  $R_I$  , gained by the student during the semester, by conducting additional control measures to admission with appropriate reflection results in Electronic campus \_
- of competencies provided by the educational program is determined by on the basis of ongoing control measures, as well as the student's fulfillment of conditions admission to exam respectively to approved by the RSO.
- Examination rating may be exhibited "automatic" by formula by counting starters points for 100-point scale:

$$R = 60 + \frac{40(R_I - R_D)}{R_C - R_D}$$

Translated to examination evaluations according to with table 1.

**9. Additional information with disciplines (educational component)**

IN case distance form of education, the organization of the educational process is carried out with application electronic mail, Telegram , video conferences in zoom , educational platforms Moodle .

Current CONTROL may to be held in in the form test control works in Moodle .

**The working program of the academic discipline ( syllabus ):**

**Designed by** Associate Professor of the Department of Mathematics Analysis and Probability

Theory, PhD, Iryna Ihorivna Golichenko

**Adopted by** the Department of MA and PT (protocol No. 16 dated 07/08/2022)

**Approved by** Methodical by the FMF council (protocol No 8 from 07/11/2022)