

Program
final control of the course "Mathematical Analysis-2" for the 2024
academic year

Faculty: Mechanics and Mathematics

Department: Mathematics

Code and name of the educational program: "6B07111 Space technic and technology",
"6B07110 Robotic systems", "6B05403 Mechanics"

Discipline name: Mathematical Analysis-2

Course: 1

Lecturer: Sautbekova M.

Protocol and date of consideration and approval by the department: №10, 07.11.23

The form of final control in an academic discipline is oral traditional (topics should be included: SRO, seminars)

Platform: no

Oral exam - the student takes an exam in the building in front of the examination committee according to the exam schedule by answering the questions on the ticket. The exam is monitored by a video camera.

TRADITIONAL ORAL EXAMINATION – ANSWERS TO QUESTIONS.
Conducted offline. The exam format is synchronous.

The process of passing an oral examination by a student involves **the creation of an examination paper for the student**, which must be answered before the examination committee.

EXAMINATION REGULATIONS

IMPORTANT – the exam is conducted according to a schedule that must be known to students and teachers in advance. This is the responsibility of the departments and faculty.

STUDENT

1. It is necessary to come to the building in advance and find an audience to take the exam.
2. Provide identification and sign the appearance form.
3. Enter according to your queue.
4. Take a ticket and prepare to answer the questions on the ticket.
5. The duration of preparation is determined by the commission (recommended 10 minutes preparation and 5 minutes response).
6. After preparation, the student defends his answers before the commission.

List of topics for the final exam in the discipline

1	Indefinite integral. The concept of antiderivative function. Indefinite integral. Basic properties of the indefinite integral. Table of basic indefinite integrals. Basic methods of integration: integration by change of variable, integration by parts.
2	Integrating rational expressions. The concept of a rational function. Decomposition of a proper rational fraction into the sum of the simplest elementary fractions. Integration of elementary fractions. Method of undetermined coefficients. Ostrogradsky method.
3	. Integration of irrational expressions. Integrating trigonometric expressions. Integration of fractional-linear irrationalities. Integration of quadratic irrationalities. Euler's substitutions. Integration of a differential binomial. Integrability in elementary functions of trigonometric expressions.
4	Definite integral. Definition of the upper and lower Darboux sums, their basic properties. Upper and lower Darboux integrals. Darboux integrability of a function. Riemann integral sums. Integral as the limit of Riemann sums. Conditions for the existence of a definite integral. Integrability criterion. Classes of integrable functions.
5	. Properties of a definite integral. Integral with a variable upper limit and its properties. Newton-Leibniz formula. Integration by change of variable and integration by parts in a definite integral. Integral estimates. Integration of inequality. First mean value theorem. Second mean value theorem. The remainder term of the Taylor formula in integral form.
6	Applications of a definite integral. Length of the arc of the curve. The concept of a simple curve, a parameterizable curve, a rectifiable curve. Properties of rectifiable curves. Curve straightness criterion. Calculation of the arc length of a curve. Arc differential. The concept of the boundary of a set and a flat figure. Area of a flat figure. Area of a curved trapezoid and a curved sector. Examples of area calculations. Body volume. Some classes of cubed bodies.
7	Approximate calculation of a definite integral. Basic principles of constructing formulas for approximate calculation of a definite integral. The simplest quadrature formulas (rectangles, trapezoids, Simpson's formula).
8	Improper integrals. Improper integrals of the 1st and 2nd kind. Cauchy criterion for the convergence of improper integrals. Change of variables under the improper integral sign and formula for integration by parts. Improper integrals of nonnegative functions; signs of their convergence. Absolute and conditional convergence of improper integrals. Dirichlet and Abel convergence tests. The main value of the improper integral.
9	Number series. Positive number series. Concepts of number series, convergence and sum of number series. Basic definitions. Properties

	of convergent series. Cauchy criterion for series convergence. A necessary condition for the convergence of a number series. Number series with non-negative terms, signs of their convergence: comparisons, Cauchy, D'Alembert, Raabe, Gauss. Integral Cauchy test for the convergence of a number series with non-negative terms.
10	Arbitrary number series. Types of convergence. Alternating number series. The concept of absolute and conditional convergence of a number series. Dirichlet and Abel tests for the convergence of alternating series. Abel transformation. Alternating number series, Leibniz's test.
11	Operations on convergent series. Associativity of convergent number series. Commutativity: on the permutation of terms of an absolutely convergent series (Cauchy's theorem), on the permutation of terms of a conditionally convergent series (Riemann's theorem). Arithmetic operations on convergent series.
12	Functional sequences and series. Concepts of functional sequence and functional series; their convergence at a point and on a set.
13	Uniform convergence on a set. Properties of functional sequences and series. Uniform convergence on a set. Cauchy criterion for uniform convergence of a functional sequence and a functional series. Sufficient criteria for the uniform convergence of functional sequences and functional series: Weierstrass, Dirichlet, Abel and Dini. Termwise transition to the limit. Continuity of the sum of a series. Term-by-term integration and term-by-term differentiation of functional sequences and functional series.
14	Power series. Expansion of a function into a power series. Power series and the region of its convergence. Abel's theorem. Radius of convergence, Cauchy-Hadamard formula. Continuity of the sum of a power series. Theorems on term-by-term integration and term-by-term differentiation of power series. Expansion of a function into a power series. Taylor series. Expansion of some elementary functions into Taylor series. Weierstrass's theorem on the uniform approximation of a continuous function by polynomials, trigonometric polynomials.

LIST OF RECOMMENDED BOOKS

1. Wladimir Zorich: "Mathematical Analysis I", 4th edition, Springer-Verlag, Berlin, 2004.
2. Fikhtengolz G.M.: "The Fundamentals of Mathematical Analysis", Volume I, Pergamon Press, Translated edition, 1979.

Internet resources

Available online: Additional educational material is available on your page on the website univer.kaznu.kz in the EMCD section.

Evaluation Criteria (Rating Scale):

«excellent» -	A	4,0	95-100
	A-	3,67	90-94
«good» -	B+	3,33	85-89
	B	3,0	80-84
	B-	2,67	75-79
	C+	2,33	70-74
«satisfactory» -	C	2,0	65-69
	C-	1,67	60-64
	D+	1,33	55-59
	D-	1,0	50-54
«unsatisfactory» -	FX	0,5	25-49

GRADING POLICY BAK/MAG/DOC STANDARD EXAM: ORAL

№	Criterion/score	Дескрипторы				
		Excellent 90–100% (27-30 points))	Good 70–89% (21-26 points))	Satisfactory 50–69% (15-20 points))	Unsatisfactory 25–49% (8-14 points))	0–24% (0-7 points)
1 question 30 point	Knowledge and understanding theories and concepts course	An “excellent” grade is given for an answer that contains an exhaustive explanation of the question, a detailed argumentation for each conclusion and statement, is constructed logically and consistently, and is supported by examples from the developed classroom topics.	The grade “is given well for an answer that contains a complete but not exhaustive coverage of the issue, an abbreviated argumentation of the main provisions, and allows for a violation of the logic and sequence of presentation of the material. The answer contains inaccurate use of terms.	A “satisfactory” grade is given for an answer that contains incomplete coverage of the questions proposed in the ticket, superficially argues the main points, in the presentation allows for violations of the logic and sequence of presentation of the material, and does not illustrate theoretical points with examples from the developed class notes.	Incorrect coverage of the questions posed, erroneous argumentation, factual and verbal errors, assumption of an incorrect conclusion.	Ignorance of basic concepts, theories...; Violation of the Rules for final control.
2 question 30 point	Application of favorites methods and technologies to specific practical tasks	Complete completion of the educational assignment, a detailed, reasoned answer to the question posed, followed by solving practical problems of the course;	Partial completion of the educational assignment, incomplete, sometimes reasoned answer to the question posed with an incomplete solution to the practical problems of the course; illiterate use of scientific language norms in the course;	The material is presented in fragments, in violation of logical sequence, factual and semantic inaccuracies are made, and theoretical knowledge of the course is used superficially.	An irrational method of solving a task or an insufficiently thought-out answer plan; inability to solve problems, perform tasks in general; making mistakes and omissions that exceeds the norm.	Inability to apply knowledge and algorithms to solve tasks; inability to draw conclusions and generalizations. Violation of the Rules for final control.

Exam papers consist of 3 questions. For correctly completed tasks, the maximum is 100 points, of which 30 points for the first question, 30 points for the second question, and 40 points for the third question.