

SYLLABUS

Fall semester 2023-2024 academic year

Educational program “6B07111 Space technic and technology”, “6B07110 Robotic systems”, “6B05403 Mechanics”

ID and name of course	Independent work of the student (IWS)	Number of credits			General number of credits	Independent work of the student under the guidance of a teacher (IWST)
		Lectures (L)	Practical classes (PC)	Lab. classes (LC)		
22069 - Mathematical Analysis-2	6	1.7	3.3	0	5	7
ACADEMIC INFORMATION ABOUT THE COURSE						
Learning Format	Cycle, component	Lecture types	Types of practical classes	Form and platform final control		
<i>Offline</i>	base	Problematic, analytical	Problematic, problem solving	Oral		
Lecturer - (s)	Merey Sautbekova, senior-lecturer					
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ACADEMIC COURSE PRESENTATION						
Purpose of the course	Expected Learning Outcomes (LO) * Describe what is the result of studying the course the student will be able to:			Indicators of LO achievement (ID) As a result of studying the discipline, the student will be able to:		
Study of the basic fundamental concepts of mathematical analysis and methods of differential calculus of a function of one real variable.	LO 1. 1. Explain the key concepts of mathematical analysis (indefinite integral, definite integral, series) in the context of relevant theories (theory of numerical and functional series, power series, integral calculus of a function of one real variable);			ID 1.1 Demonstrates theoretical knowledge of the subject (basic concepts, theorems, rules).		
	LO 2. Apply the studied material to solve typical problems in specific practical situations.			ID 1.2 Has a clear understanding of the methods of mathematical analysis.		
				ID 2.1 Uses various integration methods to find the integral of a given function.		
				ID 2.2 Uses definite integrals to solve problems in geometry, mechanics and physics.		
				ID 2.3 Explores the convergence of number series.		
				ID 2.4 Finds the sums of some numerical and functional series.		
	LO 3. Conduct independent study of additional material on the discipline.			ID 2.5 Expands a function into a power series.		
				ID 3.1 Solve and format problems in the form of a project, abstract, or scientific review.		
	LO 4. 4. Possess basic communication skills and tools for solving assigned tasks.			ID 3.2 Checks the uniform convergence of function series.		
				ID 4.1 Share and discuss the results of solving problems.		
			ID 4.2 Enter into dialogue, defend his point of view, and adequately perceive criticism.			

		ID 4.3 Able to work and interact in a team when solving specific problems.
Prerequisites	Mathematics course as part of the school curriculum. Mathematical analysis 1.	
Postrequisites	Functions of several variables. Vector analysis. Comprehensive analysis. Differential equations.	
Learning Resources	<p>Literature: main, additional.</p> <ol style="list-style-type: none"> Zorich W. Mathematical Analysis 1, Springer, 2000. Фихтенгольц Г.М. Курс дифференциального и интегрального исчисления. т.1, М., 2001; Демидович Б.П. Сборник задач и упражнений по математическому анализу, 2002 Бутузов В.Ф. и др. Математический анализ в вопросах и задачах. М., 2001 Кудрявцев Л.Д. Курс математического анализа. т.1. Дифференциальное и интегральное исчисления функций одной переменной. М – 2003 Шерстнев А.Н. Конспект лекций по математическому анализу, 2003 <p>Internet resources:</p> <ol style="list-style-type: none"> https://www.math.uni-bonn.de/ag/ana/SoSe2015/analysis2/lecture_notes/Analysis_2.pdf https://mu.ac.in/wp-content/uploads/2021/01/Mathematical-Analysis-II.pdf https://www.academia.edu/29342614/MATHEMATICAL_ANALYSIS_II_INTEGRAL_CALCULUS https://www.math.unipd.it/~parsifal/ESNTP/AN2Architecture/Calculus2.pdf 	

Academic course policy	<p>The academic policy of the course is determined by <u>the Academic Policy and the Policy of Academic Integrity of Al-Farabi Kazakh National University</u> . Documents are available on the main page of IS Univer .</p> <p>Integration of science and education. The research work of students, undergraduates and doctoral students is a deepening of the educational process. It is organized directly at the departments, laboratories, scientific and design departments of the university, in student scientific and technical associations. Independent work of students at all levels of education is aimed at developing research skills and competencies based on obtaining new knowledge using modern research and information technologies. A research university teacher integrates the results of scientific activities into the topics of lectures and seminars (practical) classes, laboratory classes and into the tasks of the IWST, IWS, which are reflected in the syllabus and are responsible for the relevance of the topics of training sessions and assignments.</p> <p>Attendance. The deadline for each task is indicated in the calendar (schedule) for the implementation of the content of the course. Failure to meet deadlines results in loss of points.</p> <p>Academic honesty. Practical/laboratory classes, IWS develop the student's independence, critical thinking, and creativity. Plagiarism, forgery, the use of cheat sheets, cheating at all stages of completing tasks are unacceptable.</p> <p>Compliance with academic honesty during the period of theoretical training and at exams, in addition to the main policies, is regulated by <u>the "Rules for the final control" , "Instructions for the final control of the autumn / spring semester of the current academic year" , "Regulations on checking students' text documents for borrowings"</u>.</p> <p>Documents are available on the main page of IS Univer .</p> <p>Basic principles of inclusive education. The educational environment of the university is conceived as a safe place where there is always support and equal attitude from the teacher to all students and students to each other, regardless of gender, race / ethnicity, religious beliefs, socio-economic status, physical health of the student, etc. All people need the support and friendship of peers and fellow students. For all students, progress is more about what they can do than what they can't. Diversity enhances all aspects of life. All students, especially those with disabilities, can receive counseling assistance by phone / e- mail mercy.sautbekova@gmail.com or via video link in Zoom.</p> <p>Integration MOOC (massive open online course). In the case of integrating MOOC into the course, all students need to register for MOOC. The deadlines for passing MOOC modules must be strictly observed in accordance with the course study schedule.</p>
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ATTENTION! The deadline for each task is indicated in the calendar (schedule) for the implementation of the content of the course, as well as in the MOOC. Failure to meet deadlines results in loss of points.			
INFORMATION ABOUT TEACHING, LEARNING AND ASSESSMENT			
Score-rating letter system of assessment of accounting for educational achievements			Assessment Methods
Grade	Digital equivalent points	points, % content	Assessment according to the traditional system
A	4.0 _	95-100	Great
			<p>Criteria-based assessment is the process of correlating actual learning outcomes with expected learning outcomes based on clearly defined criteria. Based on formative and summative assessment.</p> <p>Formative assessment is a type of assessment that is carried out in the course of daily learning activities. It is the current measure of progress.</p>

A-	3.67	90-94	Fine	Provides an operational relationship between the student and the teacher. It allows you to determine the capabilities of the student, identify difficulties, help achieve the best results, timely correct the educational process for the teacher. The performance of tasks, the activity of work in the classroom during lectures, seminars, practical exercises (discussions, quizzes, debates, round tables, laboratory work, etc.) are evaluated. Acquired knowledge and competencies are assessed. Summative assessment - type of assessment, which is carried out upon completion of the study of the section in accordance with the program of the course. Conducted 3-4 times per semester when performing IWS. This is the assessment of mastering the expected learning outcomes in relation to the descriptors. Allows you to determine and fix the level of mastering the course for a certain period. Learning outcomes are evaluated.	
B+	3.33	85-89		Formative and summative assessment	Points
B	3.0	80-84		Work in practical classes	18
B-	2.67	75-79		Independent work	42
C+	2.33	70-74	Satisfactorily	Final control (exam)	40
C	2.0	65-69		TOTAL	100
C-	1.67	60-64	Unsatisfactory		
D+	1.33	55-59			
D	1.0	50-54			

Calendar (schedule) for the implementation of the content of the course. Methods of teaching and learning.

Week	Topic name	Number of hours	Maximal scores
1	L1. 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.	1	
	PC 1. Solving problems on the topic "Calculation of indefinite integrals using basic integration methods."	2	2
2	L2. 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.	1	
	PC 2. Solving problems on the topic "Integration of rational expressions."	2	2
	IWST 1. Consultations on the implementation of IWS -1		
3	L3. 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.	1	
	PC 3. Solving problems involving the integration of irrational and trigonometric expressions.	2	2
Module 2. Riemann definite integral and its application. Improper integrals.			
4	L4. 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.	1	
	PC 4. Calculation of a definite integral directly from the definition.	2	2
	IWS 1. Test-1		35
5	L5. 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.	1	
	PC 5. Solving problems on the topic "Calculating a definite integral using a change of variable and integration by parts."	2	2
	IWST 2. Consultation on implementation of IWS-2		
6	L6. 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	1	

	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.		
	PC 6. Solving problems on the topic “Calculating the length of the arc of a curve and the area of a curvilinear trapezoid”	2	2
	IWS 2. Passing SRS-1(d.z) (Solving problems using materials from weeks 1-5)		15
	IWST 3. Consultation on the implementation of SRO-3		
7	L7. 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).	1	
	PC 7 Solving problems on the topic “Calculating the volume of a body of revolution.”	2	3
	IWS 3. Test-2		35
Frontier control 1			100
8	L8. 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.	1	
	PC 8. Solving problems on the topic “Calculation of improper integrals.”	2	2
Module 3. Number series and infinite products.			
9	L9. 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.	1	
	PC 9. Solving problems on studying the convergence of number series with non-negative terms.	2	2
10	L10. 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.	1	
	PC 10. Study of the convergence of alternating number series.	2	2
	IWST 4. Consultation on the implementation of IWS-4		
11	L11. 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.	1	
	PC 11. Solving problems to study the convergence of alternating number series.	2	2
12	L12. Infinite multiplications.	1	
	PC 12. Solving problems on the topic “Study of the convergence of infinite products.”	2	2
	IWS 4. Test-3		35
Module 4. Functional sequences and series.			
13	L13. Functional sequences and series. Concepts of functional sequence and functional series; their convergence at a point and on a set.	1	
	PC 13. Study of the convergence of functional sequences and functional series.	2	2
	IWST 5. Consultation on the implementation of IWS-5		
14	L14. 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.	1	
	PC 14. Study of uniform convergence of functional sequences and functional series.	2	2
	IWS 5. Test-4		35
	IWST 6. Consultation on the implementation of IWS-6		
15	L15. 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	1	

	continuous function by polynomials, trigonometric polynomials.		
	PC 15. Finding the region of convergence of a power series. Expansion of a function into a power series.	2	1
	IWS 6. Passing IWS-2(h.t.) (Solving problems based on materials from weeks 8-14).		15
	IWST 7. Consultation on preparing for exam questions.		
	Final control (exam)		40
	TOTAL for course		100

Dean _____ U. S. Abdybekov

Lecturer _____ M. Sautbekova

