Study program	Level of studies		**First cycle**	
	Study program name		**Physics Education**	
Course name	**MATHEMATICS I**			
Course ID	Semester	Course status	ECTS credits	L+E
PMAT100	**I**	**MANDATORY**	**10**	**4+4**
Lecturer				
Aims and intended learning outcomes	The aim of the course is for students to master fundamental knowledge in linear algebra and differential calculus of real functions of one real variable, and to understand their importance and application in physics. The expected learning outcomes are as follows: 1. Solve systems of linear equations and demonstrate an understanding of the nature of solutions. 2. Perform precise and efficient calculations with vectors, matrices, eigenvalues, and eigenvectors in arbitrary dimensions. 3. Demonstrate geometric understanding of vectors and vector operations in 2 and 3 dimensions and identify conic sections. 4. Solve problems involving limits, sequences, series, and functions. 5. Compute derivatives of explicitly, implicitly, and parametrically defined functions. 6. Understand the geometric and mechanical interpretation of derivatives. 7. Expand a function to power series. 8. Analyze the behavior and draw the graph of a function. 9. Calculate partial derivatives and local extrema of functions of multiple variables. 10. Utilize a formal presentation style (definition/theorem/proof or examples of use) in linear algebra and differential calculus.			

Course content

Coordinate system. Vectors in two- and three-dimensional space. Scalar, vector, and cross product of vectors and their applications. Planes and lines in three-dimensional space. Matrices, matrix operations. Matrix equations. Symmetric matrices. Inverse matrix. Determinants. Systems of linear equations, methods for solving linear systems. Euclidean vector space. Linear operators, linear transformations. Eigenvalues and eigenvectors. Linear independence and basis. Orthogonalization. Transition from one basis to another in vector space. Quadratic forms. Conic sections. Surfaces of second order. Sets of numbers. Sequences and the limit of a sequence. Bounded and monotonic sequences. Series. Convergence criteria. Power series, radius of convergence. Real functions of one real variable. Limit. Continuity and uniform continuity. Basic properties of continuous functions. Elementary functions. Differential calculus of real functions of one real variable. Basic rules of differentiation. Derivative of composite and inverse functions. Derivative of implicitly and parametrically defined functions. Geometric and mechanical interpretation of derivatives. Higher-order derivatives. Fundamental theorems of differential calculus. L'Hôpital's rule. Taylor's formula. Taylor and Maclaurin series. Examination of the behavior and sketching of the graph of a function. Functions of several variables. Partial derivatives. Local and conditional extrema.

Student workload (hours)		Grading	
Lectures and Exercises	120	Assessment method	Points
Exam preparation	130	Midterm exam	50
Total	250	Final exam	50
		Total	100

Literature

1. A. Odžak, S. Odžak, Linearna algebra i analitička geometrija (sa primjenama), Univerzitet u Sarajevu 2017
2. S. Hassani, Mathematical Methods For Students of Physics and Related Fields, 2nd ed., Springer-Verlag New York 2009
3. V. A. Zorich, Mathematical Analysis I, 2nd ed., Springer-Verlag, Berlin, 2015.

Remarks