Program	Level	First cycle		
	Name of the program	All Study Programs		
COURSE				
Course title	**Analysis I**			
Course code	Semester	Course status	ECTS	Contact hours (L+AE+LE)
PMAT 120	I	Mandatory course	9	4+4+0
Lecturer				
Course Goals	After the axiomatic foundation of the set of real numbers, the realization of the course concentrates on: - Mastering the concept of the limit value of sequence and series, - The concept of the limit value of a real function of a real variable, continuity, - Differential calculus of a real function of a real variable and its application.			
Learning Outcomes	After completing the course, the student will: - Master the criteria for convergence testing, - Master the techniques of the differential calculus of functions of a real variable, - Through examples, feel the potential of differential calculus when solving problems.			

COURSE CONTENT

- The real numbers. The axiom system of real numbers. The natural numbers, rational, irrational, algebraic and transcendental numbers. Principles: Cauchy-Cantor, Borel-Lebesque, Bolzano-Weierstrass. Countability. The uncountability of the set of real numbers.
- Sequences. The limit of a sequence. Limits and the arithmetic operations. Geometric sequences. Monotonic sequences. The number *e*. Cauchy sequences. Subsequences.
- Infinite series. Sum of series. Series of nonnegative terms. Criteria for convergence: Comparison test, Root test, Ratio test, Raabe's test. Alternating series. Alternating series test. General series. Absolute convergence. Unconditional and conditional convergence.
- Multiplication of series. Cauchy formula. Summation by parts. Infinite products.
- Real functions of one real variable. The limit of a function. Continuous functions.
- Monotonic functions. Elementary functions. Infinitesimal functions.
- Differential calculus. Derivative and differential of a function. The main rules of differentiation. Differentiation of a composite function (chain rule). Derivatives of inverse functions. Table of derivatives of the basic elementary functions.
- Invariance of the differential form. Higher order derivatives. Leibniz's formula. Higher order differentials. The basic theorems of differential calculus. Fermat's Lemma. Rolle's Theorem. The Theorems of Lagrange and Cauchy.
- L'Hospital's rule. Taylor's formula. The Cauchy and the Lagrange form of the remainder.
- Examples of Maclaurin polynomials. Peano form of the remainder. The uniqueness of Taylor's polynomial.
- Examining the properties of functions: monotonicity, extrema of functions, convexity, inflexion points, asymptotes of functions.
- Sketching graphs of functions.
- Selected examples of the application of differential calculus.

LITERATURE

1. Dž. Gušić, *Osnovi Teorije Nizova sa Zbirkom Riješenih Zadataka*, Prirodno-matematički fakultet Univerziteta u Sarajevu, Sarajevo, 2021.
2. Dž. Gušić, *Teorija Redova I* (*sa zbirkom riješenih zadataka*), Prirodno-matematički fakultet Univerziteta u Sarajevu, Sarajevo, 2022.
3. Dž. Gušić, *Teorija Redova II* (*sa zbirkom riješenih zadataka*) – in preparation.
4. V. A. Zorich, *Mathematical Analysis I*, Springer-Verlag, Berlin Heidelberg, 2004.
5. I. I. Ljaško, A. K. Boljarčuk, J. G. Gaj i G. P. Golovač, *Zbirka Zadataka iz Matematičke Analize I i II*, Naša Knjiga, Beograd, 2007.

STUDENT WORKLOAD (hours in a semester)

Lectures	60	Exercises	60	Individual work	105	T o t a l	225

GRADING			REMARKS
Criterion	Maximum points	Minimum points	
Midterm exams	100	55	
Final exam	100	55	
T o t a l	100	55	