

Óbuda University Bánki Donát Faculty of Mechanical and Safety Engineering		Institute of Mechatronics and Vehicle Engineering		
The name and code of the course: Mathematics I - Calculus I., NMXAN1EBNE				
Credit points: 6				
Training: Mechanical engineering				
Responsible: Prof. Dr. Galántai Aurél		Lecturer: Dr. Hanka László	Teacher: Dr. Hanka László	
Prerequisites		-		
Number of lessons per week:	Lecture: 3	Group seminar.: 3	Lab: 0	
Requirements:	2 midterm tests, signature, Exam			
Topics				
Basic calculus, and MatLab				
Schedule				
Time	Chapters			
Week 1.	Theory of sets. Operations, identities. Set of natural, integer, rational, real numbers. Powers, n-th root and identities. Binomial theorem. Identities for powers and for the n-th root. Logarithm and identities. Polynomials, roots, root factorization, long division.			
Week 2.	Complex numbers. Operations, the n-th root of a complex number. Algebraic form, polar form, exponential form. Transformation of complex numbers. Trigonometric functions, identities. Polynomials. Roots, factorization. Root factors.			
Week 3.	A vector in the 3 dimensional space. Coordinates, operations. Dot product, cross product, mixed product. Orthogonality. Equation of a plane, system of equations of a straight line. Matrices, operation, multiplication of matrices, transpose of a matrix. Determinant of a 2×2 and 3×3 matrix.			
Week 4.	Real functions, domain, codomain. Linear function, slope, y-intercept. Quadratic function, complete squares. Power functions, exponential, and logarithmic functions, identities. Equations, inequalities. Arc functions.			
Week 5.	Elementary functions. Operations. Monotonicity and convexity of functions. Local and global extrema. Parity. Composition of functions. Inverse function. Linear transformations of a function.			
Week 6.	Real sequence. Monotonic and bounded sequence. Limit of a sequence, basic properties. Squeeze theorem. Definition of Euler's number. Geometric sequence. The sum of the geometric series. Methods for computing the limit.			
Week 7.	Limit of function. One sided and two sided limit. Definition of infinity. Indeterminate limits. Operations with infinity. Basic limits for elementary functions. Asymptotes.			
Week 8.	Continuous functions. Operations with continuous functions. Basic theorems for continuous functions. Types of Discontinuities. Elementary functions.			
Week 9.	Definition of derivative. Geometric interpretation of the derivative. Calculation of the derivative according to the definition. Derived function. Derivative of elementary functions. The tangent line. Linear approximation.			
Week 10.	Differentiation rules. Chain rule. Derivative of an inverse. Logarithmic differentiation. Higher order derivatives. Derivative of arc functions.			
Week 11.	Application of the derivative. Finding local extrema, monotonicity of functions. Convexity and inflexion. L'Hospital's rule. Numeric solution of equations, Newton's method.			
Week 12.	The antiderivative. Indefinite integral. Basic properties. Integration of compositions. Integration by parts. Integration by substitution.			
Week 13.	The definite integral. Riemann sums. Fundamental theorem of calculus. Basic properties. Numeric integration.			
Week 14.	Application of definite integral. Calculation of area, volume of revolution, surface of revolution, arc length. Improper integrals.			

Budapest, 03.09.2018.

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Dr. Hanka László
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