

Óbuda University John von Neumann Faculty of Informatics		Institute of Applied Mathematics		
Name and code: <i>Mathematics I. - Calculus I. NMXANIEBNE</i>		Credits: 6		
<i>Computer Science Engineering BSc</i>		<i>Full time course 2022/2023. year I. semester</i>		
Subject lecturers: Dr. Vajda István				
Prerequisites: (with code)		-		
Weekly hours:	Lecture: 3	Seminar: 3	Lab. hours: 0	Consultation: 0
Way of assessment:	Exam			
Course description				
<i>Goal:</i> Students are introduced to the basic topics of mathematical calculus and they apply their knowledge to solve problems. Their learning process is aided by the MATLAB software, therefore they have to acquire at least a basic level knowledge about its usage.				
<i>Course description:</i> Real and complex numbers, inequalities, sequences of numbers, functions, differentiation and integration of single-variable functions. Applications of the differential and integral calculus.				

Lecture schedule	
Education week	Topic
1.	The algebraic form of complex numbers. Modulus and conjugate. Visualising complex numbers in Argand diagram. Operations in algebraic form (addition, multiplying by a constant, multiplication, division). The trigonometric and exponential forms of complex numbers. Conversion from one form to another. Operations in trigonometric and exponential forms (multiplication, division, raising to powers).
2.	The n -th roots of a complex number. Equations with complex unknowns. Polynomials, long division. The fundamental theorem of algebra. Factorised form of polynomials.
3.	Sequences of numbers. Monotonic and bounded sequences. Convergence and limit of sequences.
4.	Sandwich theorem. Definition of number e . The Euler sequence, geometric sequences. The sum of geometric series. Calculation of limits. Limit points.
5.	Elementary functions and their properties. Operations of functions. Monotonic and bounded functions. Extrema. Convexity and inflection points. Even, odd and periodic functions. Composition of functions. Inverse functions. Linear transformations of functions.
6.	Limits of functions at finite points. One-sided limits. Limits at the infinities. Infinity as a limit. Asymptotes. Continuity of functions. Operations and continuity. Theorems of continuous functions.

Lecture schedule	
Education week	Topic
7.	Some important limits of trigonometric, exponential and logarithmic functions. Discontinuities. Differentiability. Derivative of functions. Calculating derivatives using its definition.
8.	Derivative functions. Derivatives of elementary functions. Equations of the tangent line and the normal line. Linear approximations of functions.
9.	Operations and derivatives. (Sum rule, difference rule, product rule, quotient rule, chain rule.) Derivative of the inverse function. Logarithmic differentiation. Higher derivatives. Derivatives of the inverses of trigonometric functions.
10.	Applications of differential calculus: analysing functions, calculating extrema, finding inflection points. L'Hôpital's rule. Numeric solutions of equations. (Newton method.)
11.	Antiderivatives and indefinite integrals. Properties of indefinite integrals. Integration by parts. Integration with substitution.
12.	Definite integrals and their properties. Fundamental theorem of integral calculus. Numeric integrations.
13.	Applications of integrals: calculating areas, arc length, volumes and surface of solids of revolutions. Improper integrals.
14.	Partial fraction method. Integrating rational functions.
Midterm tests	
Education week	Midterm tests
6.	Complex numbers, sequences, functions
13.	Functions, differential and integral calculus
14.	Retake
Midterm requirements	
<p>Signature:</p> <p>It can be achieved 50-50 points at most on midterm test. (100 points altogether)</p> <p>Students can get their signature only if all the following conditions are fulfilled:</p> <p>They attend the lessons regularly (see study-and-examination-regulations-of-obuda-university.pdf).</p> <p>They don't fail to hand in both midterm tests. The results of the midterm test are at least 30% (15 points) in both cases.</p> <p>Students achieve at least 50% (50 points) on the two tests altogether.</p> <p>The tests are written in a classroom under the supervision of the teachers. They contain a theoretic part and a practical.</p> <p>Without a signature students can not register for the exam.</p>	

Retake

If a student has less than 50% of the points on the midterm tests or failed to hand in one of them, or has less than 30% of the point for one of them, then they can retake the missing midterm test or the one with less achieved points on the 14th week. In the latter case the newly achieved points will replace the points of the original test. Students can get their signature if they have at least 50 points altogether and at least 15 points for both midterm tests separately after the retake.

Students absent from more than 30% of the lessons, or failed to hand in both of their midterm tests, will be rejected. In this case, they can not take their exam in this semester.

Students who have no signature at the end of the 14th week, but are not rejected, may take the signature retake exam. On the signature retake exam they have to answer questions from the material of the whole semester. To get a signature, students have to achieve at least 60% of the point on the signature retake exam. In case they have less than 60%, but at least 55%, then they can take a short oral test as well to prove themselves.

Exam

Students have to sit a written exam, which has a theoretic part and a practical. They can get at most 30 points for the theoretic part, 40 points for the practical. They need at least 50% on both part to pass the exam. If they fulfilled these conditions, we add to their achieved points 30% of the points they achieved on the midterm test, i.e., they can have at most 100 points. The grade of the exam is decided as the table shows:

0-49%:	failed (1)
50-61%:	satisfactory (2)
62-73%:	average (3)
74-85%:	good (4)
86-100%:	excellent (5)

If only online exams will be allowed, then there will be a written and an oral part of the exam managing through Moodle and Teams. Only those students can take the oral part, who achieved at least 50% percent on the written part. To get a passing grade you have to pass both the written and the oral part. More details will be announced, if its necessary.

References

Mandatory:

J. Hass, M. D. Weir, G.B. Thomas: University Calculus Early Transcendentals, Addison-Wesley, 2007.

Recommended:

Course materials in the Moodle system. (<https://elearning.uni-obuda.hu/>)