Óbuda University John von Neumann Faculty of Informatics	Institute of Applied Mathematics

Name and code: *Mathematics I. - Calculus I. NMXAN1EBNE* **Credits: 6**
Computer Science Engineering BSc *Full time course 2020/2021. year I. semester*

Subject lecturers: Dr. Vajda István, Nás Hunor István

Prerequisites: (with code)	-			
Weekly hours:	Lecture: 3	Seminar: 3	Lab. hours: 0	Consultation: 0
Way of assessment:	Exam			

Course description

Goal: 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.

Course description: Review of the secondary school math, numbers, algebraic expressions, equations and 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 an 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 requirements	
Education week	Midterm tests
2.	Complex numbers
6.	Sequences
8.	Functions, differential calculus
12.	Differential and integral calculus
14.	Retake

Signature

Students can achieve 25-25 points on midterm test. (100 points altogether) The questions will be presented in the e-learning system (Moodle) of the university. The answers can be entered or uploaded in a given time interval. There can be multiple choice, numeric or short answer questions, but often students need to give their reasoning as well. In the latter case they have to write the answer onto a paper, scan and convert to the given format before uploading. The uploaded solution has to be eligible. Solutions sent by other methods (e.g. email) or after deadline will not be accepted.
Homework given during the semester is compulsory. Teachers may pick students to explain their solutions or solve similar problem on seminars and will ask questions to clarify the reasoning.
Students can get their signature only if they attend the lessons regularly (see study-and-examination-regulations-of-obuda-university.pdf), upload all midterm test and achieve at least 60% of the points (i.e., 60 points).
Without a signature students can not register for the exam.

Retake

If a student has less then 60% of the points on the midterm test or failed to upload one midterm test but achieved at least 45 points, then they can retake the missing midterm test or the one with least 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 60 points after the retake.
Students absent from more then 30% of the lessons, or failed to upload their midterm tests more then one time, will be rejected. In this case, they can not take their exam in this semester.
Students who have no signature at the and of the 14th week, but are not rejected, may take 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

There is a written and an oral part of the exam. The questions of the written part can be found in the Moodle system on the day of the exam. Students have to write their answers onto a paper, then scan and convert to the given format before uploading it in the Moodle system. Solutions sent by different method, or in different format or after the deadline will not be accepted. Students scored less than 50% of the points can not take the oral part, they failed the exam. The grade of the written part 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)

The oral part is organised via Microsoft Teams. After checking the written part we make a schedule, which can be found in the Moodle system. During the oral exam the examinee has to be on show and other people are not allowed to be in the same room with them. The examinee has to present their identity card at the beginning of the exam. They are not allowed to use head or earphone, books or other written material, mobile phone. The only allowed tools are a calculator, some sheets of paper, pen or pencil.
At the and of the exam the teacher decides the grade of the oral part. If a student fails the oral part, then the whole exam is failed. Otherwise the teacher decides the grade based on the average of the results of the written and oral parts.

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/)

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