Assessment and subject description

Óbuda University Kandó Kálmán Faculty of Electrical Engineering	Institute of Microelectronics and Technology			
Subject name and code: **Mathematics I KMEMA11ANC** Credits**: 6** **Full-time, Autumn Semester**				
Course: Electrical engineering				
Responsible: Dr. Kovács Judit	Teaching staff: Schmidt Edit			
Prerequisites:	---			
Contact hours per week:	Lecture: **3**	Class discussion.: **2**	Lab hours: **0**	Tutorial: **0**
Assessment and evaluation:	written examination			

Subject description

Aims: Emphasis is on basic topics of mathematics. Class discussions help students to solve problems in connection with the topics. This course will promote the development of algebraic and analytic skills as well as conceptual understanding.

Topics to be covered: Linear algebra. Complex numbers. Vector geometry. One-variable calculus. Multivariable calculus.

Topics	Week	Lessons
Complex numbers. Concept of complex numbers. Introduction of 3 forms of complex numbers. Representation of complex numbers on Argand diagram / the complex plane. Elementary operations in algebraic form. Elementary operations in trigonometric and exponential forms. Applications for electricity.	**1.**	**3+2**
Linear algebra. I. Concept and characteristics of the determinant. Solution of linear equation systems by Cramer's Rule.	**2.**	**3+2**
Linear algebra II. Concept of matrices. Special matrices. Basic operations of matrices. Solution of linear equation systems by Gauss- elimination.	**3.**	**3+2**
Vector geometry. Concept of vectors. Basic operations of vectors (addition, subtraction, scalar multiplication, dot product and cross product). Coordinates of vectors. Operations of vectors given by coordinates. Applications (equation of the plane and line, calculation of work, torque, etc.)	**4.**	**3+2**
Sequences. Concept of sequences. Bounded sequences, monotonicity, limit of sequences, convergence. Types of sequences (geometric progression, $\left(1+\frac{1}{n}\right)^n$, etc.).	**5.**	**3+2**
Test 1.	**6.**	**3+2**
Real-valued functions of one variable I. General concept of functions. Inverse function. Composite function. Real-valued functions of one variable. Bounded functions, monotonicity, even and odd functions, periodicity, convexity, points of inflection, extrema. Limits of functions on the real line and involving infinity. One-sided limits. Continuity. Limits of extra interest ($\frac{\sin x}{x}, \left(1+\frac{1}{x}\right)^x$, etc.).	**7.**	**3+2**

Real-valued functions of one variable II. Elementary functions (polynomial, exponential, trigonometric functions) and inverses. Hyperbolic functions and inverses. *Differential calculus I.* Concept of differential quotient. Geometric and physical meaning. Rules for finding the derivative (constant rule, sum rule, product rule, quotient rule). Chain rule and rule for finding the derivative of the inverse function. Derivatives of elementary functions	**8.**	**3+2**
Differential calculus II. Mean value theorems. L'Hospital's rule. Higher derivatives. Discussion of functions by using derivatives. Examples.	**9.**	**3+2**
Differential calculus III. Equivalent definitions for the derivative. Connection between differentiability and continuity. Optimization problems. Tangent line, velocity, acceleration, etc. *Multivariable real-valued functions* Concept of multivariable functions. Partial derivatives of multivariable functions. Geometric meaning for partial derivatives of two-variable functions. Directional derivatives. Tangent planes. Applications.	**10.**	**3+2**
Holiday	**11.**	**--**
Indefinite integrals/antiderivatives I. Concept of primitive functions and antiderivatives. Properties of antiderivatives. Integrals of basic functions. Techniques of integration: $\int f(ax+b)\,dx,\ \int f^{\alpha}(x)\cdot f'(x)\,dx,\ \int \frac{f'(x)}{f(x)}\,dx,\ \int f(g(x))\cdot g'(x)\,dx$. Integrals of trigonometric functions. .	**12.**	**3+2**
Test 2. *Indefinite integrals/antiderivatives II.* Integration by parts. Integrals of rational functions. Partial fractions in integration. Integration by substitution. $\left(\int R(\sqrt[n]{ax+b})\,dx,\ \int R(e^{x})\,dx,\ \int R(\sin x, \cos x)\,dx \text{ etc.}\right)$.	**13.**	**3+2**
Definite integrals/Riemann-integral. Concept of definite integrals. Properties. Fundamental theorem of calculus. Applications (finding area, arc length and volume by integration).	**14.**	**3+2**

Assessment

Students are expected to attend every lectures and class meetings. Students overtaking the possible misses according to Policy (TVSZ**) may not be given a signature ("disabled")** and there will be **no make-up** allowed under any circumstances.
Students are expected to take all tests as scheduled below. During the tests **calculators** and other electronic devices **must not be used.** Students need to achieve at least score 50 from the maximum score 100 to obtain signature.

	Time	**Length**	**Max. score**	**Topics**
Test 1	17th October	45 minutes	50	Linear algebra. Complex numbers. Vector geometry.
Test 2	5th December	45 minutes	50	Differential calculus of real-valued functions with one variable.
Make-up tests	On week 8th Dec. – 12th Dec.	45 (75) minutes	50 (100)	Topics of the missing tests.

Make-up tests:
Make-up tests are available only for students not ”disabled”.

- Any student not disabled may take an overall make-up test (topics of both test 1 and 2) with duration 75 minutes and max. score 100.
- Any student, who has taken one of the tests and missed the other one for documented reasons, may also take a make-up only for the missing test.
- Any student who has taken both tests may take a make-up for the original test with smaller achieved score. In this case the score of the make-up test will be counted, even if it is smaller than the score of the original test. If the achieved score of both original tests are equal, then the student may decide which make-up test to take.
- Any students not disabled who could not get the signature in any ways in the autumn semester may take an overall make-up test once on a scheduled date during the first two weeks of the examination term. The overall make-up test of the examination term covers topics of both test 1 and 2 with duration 75 minutes and max. score 100.

Assessment and evaluation: written examination.

Any student may set for the exam only after obtaining the signature for the semester. Exam tests contain problem solving (score 50, duration 60 minutes) and theoretical questions (score 20, duration 15 minutes). During the exam **calculators** and other electronic devices **must not be used.** Any students achieving less than score 35 will fail. Any students achieving at least score 35 will be given a cumulative score. If the student has not taken an overall test then the cumulative score is counted by the score of the exam plus 30 % of the score of the tests of the semester. If the student has taken an overall test then the cumulative score is counted by the score of the exam plus score 15. According to the cumulative score the mark of the exam is the following:

Cumulative score	**Mark**
86 - 100	”excellent” jeles (5)
74 - 85	”good” jó (4)
62 - 73	”fair” közepes (3)
50 - 61	”pass” elégséges (2)
0 - 49	”fail” elégtelen (1)

Recommended reference resources

1. Kovács, J., Schmidt E., Szabó, L.A.: Mathematics, ÓE KVK 2103, Budapest, 2013

2. Kovács, J., Schmidt E.: Mathematics. Problem Solving, E-learning

3. RA Adams, Ch Essex: Calculus: A Complete Course , Publisher: Toronto, Pearson Canada 2009, 973 pages, ISBN 9780321549280

03-07-14 Dr. Kovács Judit (responsible)