

SYLLABUS

Name: **Calculus and differential equations (MakAu>SI1CADE19)**

Name in Polish:

Name in English: **Calculus and differential equations**

Information on course:

Course offered by department: Faculty of Automatic Control, Electronics and Computer Science
Course for department: Silesian University of Technology

Default type of course examination report:

EGZ

Language:

English

Course homepage:

<https://platforma2.polsl.pl/rms/course/view.php?id=125>

Short description:

Course objectives:

the efficient use of the basic mathematical apparatus (limits, derivatives) necessary for the further study, the ability to formulate problems and their description in the mathematics language and to interpret obtained results.

Prerequisites and additional requirements, taking into account the course sequence:

knowledge of mathematics at (at least) the secondary school level, especially rational equations and inequalities, graphs and basic properties of linear, quadratic, trigonometric, exponential, logarithmic functions, equations of line, circle, parabola, hyperbola; knowledge of English language.

Description:

ECTS: 6

Total workload: 150 h (75 contact hours, 75 students' own work hours)

Forms of contact hours:

lecture 30 h

classes 30 h

other (consulting hours, retake tests, exam): 15 h

Students' own work: homework, preparation for lecture, classes, tests, exam

Lecture:

The concept of a function; examples. One-to-one onto functions; composit functions, inverse functions. Review of elementary functions; hyperbolic and inverse trigonometric functions.

Metric and metric spaces; cluster, interior, frontier, isolated points; open, closed, bounded sets.

Sequences (of real numbers, complex numbers, plane points) and their limits in metric spaces. Properties of convergent sequences. Limits of some numerical sequences.

The limit of a function (the Heine and Cauchy definitions in metric spaces). Properties of limits. Some important limits of real-valued functions of one real variable. Continuity, discontinuity, properties of continuous functions. Asymptotes.

The derivative of a function – definition, interpretations. Differentiation formulas and rules. Higher derivatives. Differentials – definition, applications. Fermat's Theorem. Rolle's Theorem, Lagrange's Theorem, Cauchy's Theorem. L'Hospital's rules. Taylor's formula. Critical points and extreme values – the First Derivative Test. Concavity and inflections – the Second Derivative Test. Sketching the graph of a function.

Antiderivatives and indefinite integrals. Integration by parts, the Substitution Rule, integration of rational functions.

Classes:

the same as for the lecture, solving concrete problems, strategy, result discussion

Lecture is led traditionally. During the lecture definitions and theorems are presented (some of them with proofs); all notions are illustrated by examples. Presentations are available on the Platform of Remote Education.

Classes are led traditionally. During classes the students practice contents given during the lecture, they solve (on their own or with help of the teacher) tasks proposed by the teacher.

Method and procedure for making up for

- student's absence from the course:

student should fill his/her knowledge gaps, one can make use of consulting hours,

student with explained absence for the day when a test took place, can take this test on the last lecture (it should be reported to the lecturer 7 days earlier),

- differences in study programmes for students changing their field of study, changing university or resuming studies at the Silesian University of Technology:

one should pass the missing learning outcomes and topics during the tests and/or exam (according to the subject card); all necessary documents must be delivered to the lecturer by October 15th.

Bibliography:

basic:

B. Sikora, E. Łobos, A First Course in Calculus

E. Łobos, B. Sikora, Advanced Calculus – Selected Topics

E. Łobos, J. Macura, B. Sikora, Calculus and Linear Algebra in Exercises, part 1

S.R. Lay, Analysis with an Introduction to Proof

W. Rudin, Principles of Mathematical Analysis

R.A. Adams, Calculus: a Complete Course

W.F. Trench, Introduction to Real Analysis

other:

educational platform Compass - <https://compass-edu.pl/>

interaktywna platforma ForMath (in Polish) – <http://4math.ms.polsl.pl/>

czasopismo dydaktyczne (wzbrane artykuły, some in Polish) – <http://minut.polsl.pl/>

Learning outcomes:

At the completion of the course, student:

knows and understands basic definitions and theorems of elementary functions and differential calculus of one variable (exam) K1A_W01
can calculate limits and derivatives, correctly apply appropriate theorems to test selected properties of functions (tests) K1A_U09

Assessment methods and assessment criteria:

During the classes it is obligatory to know the definitions, theorems and formulas given in the lectures. After each classes the student is obliged to do the homework (about 20 examples, freely chosen, medium difficulty level and adequate to the topic of classes). Student who is unprepared for the classes can obtain negative points for activity.

Students can obtain extra points for the activity on the lecture (added to the points obtained during classes or during exam – according to the student's choice).

There will be three tests per semester, during classes. Tests should be written on foolscap (A3). The use of teaching aids, calculators, phones, etc. is forbidden. Each task is graded from 0 to 5 points. In classes one can get additionally 10 points for activity (oral answers).

The necessary and sufficient condition to pass the classes is the completion of all learning outcomes which are grouped into blocks:

B1 (elementary functions, without derivative)

B2 (limits of sequences and functions)

B3 (applications of derivative)

B4 (the derivative of non-trivial composite function).

Passing mark for B1-B3 is 6 p., for B4 - 3 p.

Students who haven't pass some of blocks B1-B4 may try to pass them on retake tests. The retake tests will be organized during examination session. The points from the retake tests are not added to the points obtained during classes.

After passing all learning outcomes B1-B4 the classes are graded. This mark (C) is determined by the sum of points obtained at tests and from activity: less than 36 p. - satisfactory (3.0), 36 p. – satisfactory plus (3.5), 41 p. - good (4.0), 45 p. – good plus (4.5), 50 p. – very good (5.0).

The exam is written (a test of multiple choice and filling the gaps) and it verifies one learning outcome regarding knowledge. The pass mark is 40% (24 p.).

The exam is graded (E) as follows: 24 p. – satisfactory (3.0), 36 p. – satisfactory plus (3.5), 41 p. - good (4.0), 45 p. – good plus (4.5), 50 p. – very good (5.0).

Only students who passed at least three blocks B1-B4 may take the exam (a failed block must be passed on the retake tests). Other students lose the date of exam.

The final grade is based on grades obtained in classes (C) and in exam (E), if all learning outcomes are passed, according to the formula: $\max \{3,1/2(C+E)-K\}$, where $K \in \{0,1,2,3\}$ is the number of previously failed exams/classes. The exam grade is decisive for rounding. If a student did not take the exam because of the failure of some B1-B4, it results in obtaining the unsatisfactory mark for the exam.

The syllabus is valid from academic year 2024/25 and its content cannot be changed during the semester

Course credits in various terms:

<without a specific program>				
	Type of credits	Number	First term	Last term
European Credit Transfer System (ECTS)		6	2020/2021-Z	