# SYLLABUS

**Name:** ***Calculus and differential equations (MakAu>SI2CADE19)***
**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://platforma.polsl.pl/rms/course/view.php?id=1084

**Short description:**

Course objectives:
the efficient use of the basic mathematical apparatus (integrals, functions of several variables, differential equations) 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 calculus and algebra from the 1st semester, especially: limits, derivatives without mistakes, quadratic equations in complex numbers, the Euler formula, determinants, systems of linear equation; knowledge of English language.

**Description:**

ECTS: 5
Total workload: 125 h (65 contact hours, 60 students' own work hours)
Forms of contact hours:
lecture 30 h
classes 30 h
other (consulting hours, retake tests, exam): 5 h

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

Lecture:
Examples of rationalizing substitutions. The definite integral – definition, properties. Fundamental Theorems of Calculus. Applications (area between two curves, arc length). Improper integrals.
Functions of several variables. Partial derivatives. Total differential. Chain rules. Implicit differentiation. Directional derivative and gradient vector. Extreme values (of functions of two variables).
Separable equations. First order linear differential equations. Linear independence of functions and Wonskian. Second order linear differential equations with constant coefficients. The method of undetermined coefficients, the method of variation of parameters. The Laplace transformation – properties, computations, application in differential equations.

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 March 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:
interaktywna platforma ForMath (in Polish)– http://4math.ms.polsl.pl/
MINUT (selected articles, some in Polish) – http://minut.polsl.pl/
additional teaching materials on the platform of remote education

**Learning outcomes:**

At the completion of the course, student:
knows and understands basic definitions and theorems of integral calculus and differential calculus of several variable (exam, short theory quiz) K1A_W01

knows and understands basic ordinary differential equations and methods of solving them (exam, short theory quiz) K1A_W08
can evaluate and apply integrals, calculate and apply partial derivatives, solve differential equations (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 7 points for activity (oral answers) and 8 p. for short theory quiz.
The necessary and sufficient condition to pass the classes is the completion of all learning outcomes which are grouped into blocks: B1 – integrals with application, B2 – partial derivatives with application, B3 – differential equations. The passing mark is always 6 p.
Students who haven't pass some of blocks B1-B3 may try to pass them on retake tests. The points from the retake tests are not added to the points obtained during classes.
After passing all learning outcomes B1-B3 the classes are graded. This grade (C) is determined by the sum of points obtained at tests, short theory quiz, 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 filing the gaps) and it verifies two learning outcomes regarding knowledge;the passing mark is 24 p. if both learning outcomes are passed.
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 two blocks B1-B3 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 classes/exams. The exam grade is decisive for rounding. If a student did not take the exam because of the failure of some B1-B3, 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) | 5 | 2020/2021-L | |