

MODULE INFORMATION SHEET

Name of Module Unit	Mathematics I – Calculus I
Name in polish language	Analiza Semestr I
Module type	compulsory
Form of studying	full-time day courses
Level of study	undergraduate course (B.Sc. level)
Type of study (for extra-mural courses)	–
Programme	Environmental Engineering
Speciality	Environmental Engineering
Responsible Department	Faculty of Mathematics and Information Sciences Ordinary Differential Equations (Wydział Matematyki i Nauk Informacyjnych Zakład Równań Różniczkowych Zwyczajnych)
Responsible Person	dr Agnieszka Badeńska

Semester	Lectures (E)	Tutorials	Laboratory	Computer Exercises	Projects	ECTS
1	30 (exam)	30				6

Objectives (summary)

1. Making the students familiar with elements of the modern mathematical analysis.
2. Making the students use the mathematical analysis in practice.

Prerequisites

Advanced knowledge of mathematics from secondary school.

Rules for integrated grade definition

1. Calculus I is conducted in winter semester. It ends with an exam.
2. To take the final exam a student **must have attended tutorials** (at most two unexcused absences are allowed, at least one written test must have been taken). Credit for tutorials is not necessary.
3. The exam is written and consists of two parts: theoretical questions (definitions, theorems and their applications) and practical problems similar to those solved on tutorials. The maximal number of points one can obtain on the exam is **60**. The exam is **passed** if two conditions are satisfied:
 - the number of points obtained on the exam is **at least 31**,
 - the sum of tutorials and exam points is **at least 51**.

Recommended readings

1. G. B. Thomas, M. D. Weir, J. R. Hass, "Thomas' Calculus", Pearson Addison Wesley;
2. R. A. Adams, C. Essex, "Calculus. A complete course", Pearson Addison Wesley;
3. S. K. Stein, "Calculus and Analytic Geometry", McGraw-Hill Book Company;
4. Auxiliary materials. The set of problems for tutorials.

Contents of lectures (syllabus)

	Topics	Time (hrs.)	Scope (S/Ex)
1	Sets of numbers. Sequences and their properties. Basic theorems about sequences. Bounded monotone sequences. Number e .	6	S
2	Real functions of one variable. Limits of functions. Continuous functions Derivatives and differentials of functions. Principal theorems about differential functions: Rolle's, Lagrange's, Taylor's. Indeterminate forms and l'Hospital Rule. Extrema of functions and Fermat's Theorem. Convexity and concavity of functions. Points of inflection. Asymptotes of graphs of functions.	12	S
3	Antiderivative (primitive) and indefinite integral. Change of variables in the indefinite integral (integration by substitution). Integration by parts Integration of rational and trigonometric functions.	4	S
4	Functions of several variables – limit, continuity, partial derivatives. Extrema of functions of several variables.	4	S
5	Ordinary differential equations of the first order. Separable equations, homogeneous equations, linear equations, Bernoulli's equations. Linear differential equations with constant coefficients of order n .	4	S
Total		30	hours

S – topics listed in the legal study programme standards from 12.07.2007

Ex – extended topics

Lecturers

dr Agnieszka Badeńska

Assessment method

The subject is assessed on the basis of the sum of points obtained on tutorials and on the written exam.

The exam consists of two parts: theoretical questions (definitions, theorems and their applications) and practical problems similar to those solved on tutorials. Each part is assessed from 0 to 30 points. During the exam it is **strictly prohibited to use any auxiliary handouts**, including **mobile phones** and other **electronic devices**.

The exam is **passed** if two conditions are satisfied:

- the number of points obtained on the exam is **at least 31**,
- the sum of tutorials and exam points is **at least 51**.

If the second condition is not satisfied but a student obtained at least 27 points (45%) on the exam, the student gets credit for tutorials (if did not have it before). The tutorial mark is based on the same percentage scale and the student gains for tutorials 2/3 of points obtained on the exam (21 points if obtained 27–32 points).

Students who obtained **at least 29 points for tutorials** do not have to write the practical part of the exam (unless they want to get a better mark). The theoretical part of the exam is passed if a student obtained **at least 16 points**. In this case the student gets additionally 75% of the points obtained for tutorials.

The final mark is determined by the sum of points obtained on tutorials and on the exam following the table.

Sum of tutorials & exam points	Final mark
0–50	2.0
51–60	3.0
61–70	3.5
71–80	4.0
81–90	4.5
91–100	5.0

Contents of tutorials

	Topics	Time (hrs.)	Scope (S/Ex)
1	Exponential functions, natural logarithm, trigonometric functions, hyperbolic functions, inverse functions.	2	S
2	Limits of sequences. Applications of the 3 Sequences (Squeeze, Sandwich) Theorem.	2	S
3	Limits of sequences related to the number e.	2	S
4	Limits of functions. Continuous functions. Derivatives.	2	S
5	The Rolle's Theorem. The Lagrange's Theorem. The Taylor's Theorem. The l'Hospital Rule.	2	S
6	Extrema of functions. Convexity and concavity of functions. Points of inflection. Asymptotes of graphs of functions. Graphs of functions.	2	S
7	Test 1.	2	S
8	Antiderivative (primitive) and indefinite integral. Change of variables in the indefinite integral (integration by substitution). Integration by parts.	2	S
9	Integration of rational functions.	2	S
10	Integration of trigonometric functions.	2	S
11	Functions of several variables – limits, continuity, partial derivatives.	2	S
12	Extrema of functions of several variables.	2	S
13	Ordinary differential equations of the first order. Separable equations. Homogeneous equations.	2	S
14	Test 2.	2	S
15	Ordinary differential equations of the second order.	2	S
Total		30	hours

S – topics listed in the legal study programme standards from 12.07.2007

Ex – extended topics

Persons responsible for tutorials

dr Agnieszka Badeńska mgr Tomasz Miller
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Assessment method for tutorials

<p>Attending tutorials is obligatory. It is also a necessary condition to take the exam.</p> <p>On tutorials students will take four written (45 minutes) tests for 10 points each. One can also obtain additional points (not more than 5) for activity during the classes. However, the maximal amount of points to get on tutorials is 40.</p> <p>To receive credit for tutorials a student needs to obtain at least 21 points.</p>
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Tutorials points	Tutorials mark
0–20	2.0
21–24	3.0
25–28	3.5
29–32	4.0
33–36	4.5
37–40	5.0

Any **exceptions** from the above regulations, due to special circumstances, must be discussed with the lecturer **within the first month of the course**. This includes possible **transfer of mark** (the official syllabus is required).