MODULE INFORMATION SHEET

Name of Module Unit	**Mathematics – Calculus II**
Name in polish language	Analiza Semestr II
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
2	30 (Exam)	30				6

Objectives (summary)

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

Prerequisites

Advanced knowledge of mathematics from secondary school and Calculus 1.

Rules of integrated grade setting

1. Calculus II is conducted in summer semester. It ends with an exam.
2. To take the final exam a student **must have attended tutorials** and **levelling classes** (at most two unexcused absences are allowed, at least one written test must have been taken) and **Calculus 1 exam passed**. 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. J. Marsden, A. Weinstein, "Calculus 2", Springer (available on the Springer's website);
5. Auxiliary materials. The set of problems for tutorials.

Contents of lectures (syllabus)

	Topics	Time (hrs.)	Scope (S / Ex)
1	Linear differential equations of higher order with constant coefficients. The methods of undetermined coefficients and variation of parameters.	2	S
2	Definite integral. Properties of the definite integral. The fundamental theorems of calculus. Geometric and physical applications of the definite integral. Line integral of a scalar function. Arc length, first moments and moments of inertia, centre of mass of a curve. Improper integrals - convergent and divergent.	6	S
3	Infinite series. Sufficient conditions for convergence of series with nonnegative terms: the comparison test, the ratio test, the root test the integral test. Alternating series - absolute and conditional convergence. The Leibniz test. Function sequences and function series. The set of convergence of a function series. Power series. Radius, interval and set of convergence of a power series. Taylor and Maclaurin series. Maclaurin series of elementary functions. Fourier series. The Dirichlet theorem. Half-range expansions.	12	S
4	Riemann integral over n-dimensional regions and its properties. Double and triple integral over normal regions. The Fubini theorem. Change of variables in the multiple integral. Polar coordinates. Cylindrical and spherical coordinates. Applications of double and triple integral in mechanics.	4	S
5	Surface integral of a scalar function. The surface area. First moments and moments of inertia of a surface.	2	S
6	Line integral of a vector field. The Green's theorem. Surface integral of a vector field. The Gauss-Green-Ostrogradsky theorem. The Stokes' theorem. Gradient field. Divergence and curl of a vector field.	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 **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 50\% 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	Linear differential equations of higher order with constant coefficients. The methods of undetermined coefficients and variation of parameters.	2	S
2	Geometric and physical applications of the definite integral.	2	S
3	Arc length, first moments and moments of inertia, centre of mass of a curve. Improper integral - convergent and divergent.	2	S
4	Infinite series. The comparison test, the ratio test, the root test and the integral test.	2	S
5	Alternating series - absolute and conditional convergence. The Leibniz test. Radius, interval and set of convergence of a power series. Taylor and Maclaurin series. Maclaurin series of elementary functions.	2	S
6	Fourier series. Half-range expansions.	2	S
7	Test 1	2	
8	Double integral over normal regions. Polar coordinates. Applications of the double integral in mechanics.	2	S
9	The surface area. First moments and moments of inertia of a surface.	2	S
10	Triple integral. Cylindrical and spherical coordinates.	2	S
11	Applications of the triple integral.	2	S

12	Line integral of a vector field and its applications. The Green's theorem.	2	S
13	Surface integral of a vector field its applications. The Gauss-Green-Ostrogradsky theorem.	2	S
14	Test 2	2	S
15	The Stokes' theorem. Gradient field. Divergence and curl of a vector field.	2	
	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
dr Michał Szostakiewicz

Assessment method for tutorials

Attending tutorials is **obligatory**. It is also a necessary condition to take the exam.

On tutorials students will take **four written** 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**.

To receive **credit for tutorials** a student needs to obtain at least **21 points**.

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).