



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Mathematics [S1Energ2>Mat1]

### Course

Field of study

Power Engineering

Year/Semester

1/1

Area of study (specialization)

–

Profile of study

general academic

Level of study

first-cycle

Course offered in

Polish

Form of study

full-time

Requirements

compulsory

### Number of hours

Lecture

30

Laboratory classes

0

Other

0

Tutorials

30

Projects/seminars

0

### Number of credit points

5,00

### Coordinators

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### Lecturers

### Prerequisites

The student is expected to have knowledge of mathematics at the basic level of secondary school, extended by differential calculus (at the advanced level).

### Course objective

Familiarization with the concepts of differential and integral calculus of single-variable functions and their applications. Introduction to the concept of complex numbers and operations on complex numbers.

### Course-related learning outcomes

Knowledge:

1. The student has knowledge of the properties of sequences and the convergence criteria for number series.
2. The student has knowledge of the derivative, its determination, and applications.
4. The student has knowledge of the indefinite integral and integration methods.
5. The student has knowledge of the definite integral and its applications.
- 6 The student has knowledge of the principles of solving polynomials, exponents and roots in the set of complex numbers.

### Skills:

1. The student can examine the convergence of numerical sequences and series.
2. The student is able to determine the derivative of a function of one variable, apply it to the limits of functions (de L'Hospital rule) and study the variability of functions.
3. The student can calculate the indefinite integral - integration before substitution and through parts.
4. The student is able to calculate the definite integral, determine the area, curve arc length, volume and surface area of a rotational solid.
5. The student is able to perform operations on complex numbers, find real and complex roots of certain types of polynomials.
6. The student is able to obtain the above information from literature and other sources and integrate obtained information, interpret and draw conclusions from them.

### Social competences:

1. The student is aware of the level of its knowledge in the field of energy research.
2. The student is aware of the deepening and expansion of knowledge in order to solve new technical problems.
3. The student is able to properly set priorities for the implementation of tasks specified by himself or others, including is able to think and act strictly in the area of description of processes in technical and exact sciences.

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

1. Lecture: Knowledge acquired during the lecture is assessed through a 90-minute exam consisting of theoretical questions and problems. Passing threshold: 50% of the total points obtained on the exam. The list of exam topics will be sent by email no later than two weeks before the exam.
2. Tutorials: Knowledge acquired during exercises is assessed through two midterm tests conducted in sessions 7 and 15, as well as class participation. Each midterm test carries the same number of points. Passing threshold: 50% of the total points – the sum of points obtained from the midterm tests and class participation.

### Programme content

Methods and applications of differential and integral calculus of functions of one variable. Complex numbers.

### Course topics

#### Lecture

1. SEQUENCES: properties of boundedness and monotonicity, limits of sequences, definition of the constant  $e$  and its applications.
2. FUNCTIONS OF A SINGLE VARIABLE: definition and examples, elementary functions and their properties, continuity and limits of functions.
3. DIFFERENTIAL CALCULUS OF SINGLE-VARIABLE FUNCTIONS: definition and interpretation of the derivative.
- 4–6. DIFFERENTIAL CALCULUS OF SINGLE-VARIABLE FUNCTIONS: higher-order derivatives, applications of derivatives, qualitative analysis of functions (monotonicity, extrema, convexity).
- 7–10. INTEGRAL CALCULUS OF SINGLE-VARIABLE FUNCTIONS: indefinite integrals – basic techniques of integration; integration of rational, irrational, and trigonometric functions.
- 11–12. DEFINITE INTEGRALS: the Riemann integral and its applications; improper integrals.
13. SERIES OF REAL NUMBERS: definition, convergence tests, and examples.
- 14–15. COMPLEX NUMBERS: Cartesian form, trigonometric form, Euler's form; exponentiation and extraction of roots.

#### Tutorials:

1. SEQUENCES: boundedness, monotonicity, limit, the number  $e$ .
2. FUNCTIONS OF A SINGLE VARIABLE: limits and continuity of functions.
3. DIFFERENTIAL CALCULUS OF SINGLE-VARIABLE FUNCTIONS: computation of derivatives.
- 4–5. DIFFERENTIAL CALCULUS OF SINGLE-VARIABLE FUNCTIONS: applications of derivatives –

monotonicity, convexity, differential of a function, approximations, absolute and relative error, L'Hôpital's rule.

7. TEST I

8–10. INTEGRAL CALCULUS OF SINGLE-VARIABLE FUNCTIONS: indefinite integrals (by formula, substitution, integration by parts); integrals of rational functions; selected irrational and trigonometric integrals.

11. INTEGRAL CALCULUS OF SINGLE-VARIABLE FUNCTIONS: definite integrals and their applications.

12. INTEGRAL CALCULUS OF SINGLE-VARIABLE FUNCTIONS: improper integrals.

13. SERIES OF REAL NUMBERS: convergence criteria for numerical series.

14. COMPLEX NUMBERS: Cartesian form, trigonometric form, Euler's form; exponentiation and root extraction.

15. TEST II.

## Teaching methods

1. Lecture: multimedia presentation, illustrated with examples on the board. Conducted in an interactive way with the formulation of questions to a group of students. Initiating discussions during the lecture.

2. Exercises: solving tasks given by the teacher on the board along with analyzing the next stages. The method of solving the task by students on the board is reviewed by the tutor. Completed with tasks for independent solution at home.

## Bibliography

Basic:

1. W. Krysicki, L. Włodarski, *Analiza matematyczna w zadaniach*, T. 1, PWN, Warszawa 2011.

2. I. Fołtyńska, Z. Ratajczak, Z. Szafranski, *Matematyka dla studentów uczelni technicznych*, T. 1-3, Wydawnictwo Politechniki Poznańskiej, Poznań 2004.

3. M. Gewert, Z. Skoczylas, *Analiza matematyczna 1/Definicje, twierdzenia, wzory/* Oficyna Wydawnicza GiS, Wrocław 2011.

4. M. Gewert, Z. Skoczylas, *Analiza matematyczna 1/Przykłady i zadania/* Oficyna Wydawnicza GiS, Wrocław 2011.

5. F. Leja, *Rachunek różniczkowy i całkowy*, PWN, Warszawa 2008.

Additional:

1. W. Żakowski, *Matematyka*, T. 1-2, WNT, Warszawa 2003.

2. W. Stankiewicz, J. Wojtowicz, *Zadania z matematyki dla wyższych uczelni technicznych*, T. 1-2, PWN, Warszawa 2003.

3. M. Lassek, *Matematyka dla studentów technicznych*, T. 1-2, Wydawnictwo Wspierania procesu edukacji, Warszawa 2004.

## Breakdown of average student's workload

	Hours	ECTS
Total workload	132	5,00
Classes requiring direct contact with the teacher	62	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	70	2,50