# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Mathematics [S1Energ2>Mat2]

## Course

Field of study
Power Engineering

Year/Semester
1/2

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 should have knowledge about complex numbers, matrix calculus and its applications, differential and integral calculus of functions of one variable in the first semester of study.

## Course objective

Familiarization with the issues of differential and integral calculus of functions of many variables and ordinary differential equations. Developing students' simple solving skills math problems by using different types of equations.

## Course-related learning outcomes

1. The student has knowledge of matrices, methods of elementary operations on matrices, and principles for solving systems of linear equations.
2. The student has knowledge of scalar, vector and mixed products.
3. The student has knowledge of the calculation of partial derivatives of functions of many variables and the principle of determining the extremes of functions of many variables.
4. The student has knowledge of the multiple integral and knows how to calculate it.
5. The student has knowledge of the type of ordinary differential equations and methods of solving them.

6. The student has knowledge of the Laplace transform and its application to differential equations.
7. The student has knowledge of selected functional series and Fourier series.

Skills
1. The student can perform operations on matrices, determine the inverse matrix of elementaryoperations methods, calculate the determinant of matrices, solve a system of linear equations using the Gaussian elimination method.
2. The student can apply products in space.
3. The student is able to determine partial derivatives and local extremes of functions of many variables.
3. The student is able to calculate multiple integrals in Cartesian and polar coordinates.
4. The student recognize the type and solve the ordinary differential equation.
5. The student apply the Laplace transform in differential equations.
6. The student can designate convergence intervals in power series and determine Fourier series in the range [-,  ].
8. The student is able to obtain the above information from literature and other sources. Is able to integrate obtained information, interpret and draw conclusions from it.

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 verified by a 90 minute exam consisting theoretical and tasks.
Assessment threshold: 50% of points obtained from an exam. The exam issues will be sent via e-mail at least two weeks before the exam.
2. Knowledge acquired during the exercises is verified by two tests carried out during 7 and 15 classes and activity during classes. Each test consists of the same number of points. Passing threshold: 50% of points - the sum of points obtained from tests and activity during classes.

## Programme content

Problems of linear algebra. Differential calculus of functions of several variables. Double integral. Ordinary differential equations. Laplace transform. Functional series. Geometry of space.

## Course topics

Lecture
1-2. DEFINITE INTEGRAL: Riemann integral and its application and improper integrals.
3-4. DIFFERENTIAL CALCULUS OF FUNCTIONS OF MULTIPLE VARIABLES: definition of a function of two variables, partial derivative, Schwarz theorems, extremum of a function of two variables.
5-6. MULTI-DIMENSIONAL INTEGRAL: normal area, double integral - calculation, changing the order of integration, converting variables in the double integral to polar coordinates, applying the double integral to Cartesian and polar coordinates.
7-9. ORDINARY DIFFERENTIAL EQUATIONS: definition of ordinary differential equation, solution general and special, with separated variables, first-order linear differential equation, complete equation, Bernoulli equation, second-order linear differential equation with constant coefficients.
10-12. LAPLACE TRANSFORM: definition of the Laplace transform and its application to solving differential equations.
13. FUNCTION SERIES: power series - convergence intervals, Fourier series - methods of calculation.
14. SPACE GEOMETRY: definition of scalar, vector and mixed products and their applications.
15. Revision of the material.
Tutorials
1-2. DEFINITE Integral: Riemann integral and its application and improper integrals.

3-4. DIFFERENTIAL CALCULUS OF FUNCTIONS OF MULTIPLE VARIABLES: definition of a function of two variables, partial derivative, Schwarz's theorems, extremum of a function of two variables.
5-6. MULTI-DIMENSIONAL INTEGRAL: normal area, double integral - calculation, changing the order of integration, converting variables in the double integral to polar coordinates, applying the double integral to Cartesian and polar coordinates.
7. Test I
8-10. ORDINARY DIFFERENTIAL EQUATIONS: definition of ordinary differential equation, solution general and special, with separated variables, first-order linear differential equation, complete equation, Bernoulli equation, second-order linear differential equation with constant coefficients.
11-12. LAPLACE TRANSFORM: definition of the Laplace transform and its application to solving differential equations.
13. FUNCTION SERIES: power series - convergence intervals, Fourier series - methods of calculation.
14. SPACE GEOMETRY: definition of scalar, vector and mixed products and their applications.
15. Test II

## Teaching methods

1. Lecture: multimedia presentation, illustrated with examples given on the board. Run in interactive way with formulating questions to a group of students. Initiating discussions during lecture.
2. Exercises: solving tasks given by the teacher on the board along with analysis next stages. The way students solve the task on the board is reviewed by the leader of the exercises. Supplemented with tasks to solve on your own at home.

## Bibliography

Basic:
1. W. Krysicki, L. Włodarski, Analiza matematyczna w zadaniach, T. 1-2, PWN, Warszawa 2011.
2. I. Foltyńska, Z. Ratajczak, Z. Szafrański, Matematyka dla studentów uczelni technicznych, T. 1-3, Wydawnictwo Politechniki Poznańskiej, Poznań 2004.
M. Gewert, Z. Skoczylas, Analiza matematyczna 2/Definicje, twierdzenia, wzory/ Oficyna Wydawnicza GiS, Wrocław 2011.
4. M. Gewert, Z. Skoczylas, Analiza matematyczna 2/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 |