COURSE DESCRIPTION CARD - SYLLABUS

Course name
Mathematics [S1FT2>Mat2]

Course

Field of study
Technical Physics

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

Knowledge: The student has knowledge of mathematics from the first semester of first-cycle studies (selected issues of linear algebra, mathematical analysis and analytical geometry). Skills: The student is able to solve problems and has the ability to use mathematical tools to solve tasks in the first semester of first-cycle studies (including the ability to calculate derivatives of functions, draw graphs of functions and analyze them, calculate indefinite and definite integrals, use matrix calculus, use the series theory). Social competencies: The student understands the need for continuous improvement of competences (language, professional and social) and knows the importance of higher mathematics methods in the description of engineering and technical issues, in particular Technical Physics. Can independently search for information in the literature and is aware of the need for further education.

Course objective

The main aim is to get to know and the understanding of basic notions and methods of theory in order to apply them to solving technical problems (including differential and integral calculus of functions of many variables, ordinary differential equations, selected applications of functional series) and developing skills to solve mathematical problems by using different types of equations. Shaping students' teamwork skills.

Course-related learning outcomes

Knowledge:
1. The student has knowledge of linear algebra and mathematical analysis, analytical geometry, differential and integral calculus and the theory of differential equations, necessary to describe and analyze the operation of elements and systems appropriate for the field of Technical Physics - [K_W01, P6S_WG]
2. The student has knowledge of the application of appropriate computational techniques that support the work of an engineer, while understanding certain limitations - [K_W01, P6S_WG]

Skills:
1. The student is able to obtain information from literature, the Internet and other sources. Is able to integrate the information obtained, interpret it and draw conclusions from it - [K_U01, P6S_UW]
2. The student has the ability to self-educate, also using modern teaching tools (remote lectures and websites, teaching programs, electronic books). Is able to use formulas and tables, technical and economic calculations - [K_U05, P6S_UU]
3. The student is able to apply mathematical methods in the analysis of technical problems - [K_U07, P6S_UW]

Social competences:
1. The student understands the need to critically evaluate their knowledge and lifelong learning. Can inspire and organize the learning process of other people - [K_K01, P6S_KK]
2. The student is able to cooperate, think and work in a group - [K_K03, P6S_KO]
3. The student is able to appropriately determine priorities for the implementation of tasks specified by himself or others - [K_K04, P6S_KO]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

1) Lectures: the grade based on written/oral exam of theory and tasks.
2) Exercise classes: the passing with grade based on two written tests per semester and activities during classes.
Possibility of obtaining additional additional points related to activity during classes (presentations of examples of mathematics applications, use of literature, discussion of problems, presentation of reports on the applications of theory and careful preparation).
GRADING SCALE (Lectures and exercise classes):
<50% - 60%> - 3,0
(60% - 70%> - 3,5
(70% - 80%> - 4,0
(80% - 90%> - 4,5
(90% - 100%> - 5,0

Programme content

Differential and integral calculus of functions of many variables. Ordinary differential equations (ODE). Applications of functional series. Laplace Transformation.

Course topics

Functions of many variables - definition, domain, partial derivatives, Schwarz's theorem; geometric interpretation of the function of two variables; extremum of functions of two variables; complete differential of functions of two variables and its applications.
Integral calculus of functions of many variables - definition of normal area; definition of double integral and geometric interpretation; exchanging of a double integral to an iterated integral, changing the order of integration, exchanging of variables in a double integral to polar coordinates. Applications of multi-dimensional integrals in various coordinates.
First-order ordinary differential equations - definition, general and special solutions; Cauchy's problem. Selected types of equations and methods of solving them (equations with separated variables, linear homogeneous and non-homogeneous, Bernoulli, exact differential equation). Graphical method for solving first-order ordinary differential equations.
Second-order ordinary differential equations reducible to first-order ordinary differential equations - selected types of equations and methods of solving them.

Function series - examples of applications in solving technical problems.
On the Laplace Transformation - definition, examples and applications.

Teaching methods

1) Lectures:
- conducted in an interactive manner with questions asked to a group of students or to specific students,
- use of multimedia presentation (e.g. examples, animations),
- theory presented in connection with students' current knowledge,
- presenting a new topic preceded by a reminder of related content known to students from school,
- taking into account various aspects of the presented issues (economic, ecological, social),
- taking into account the student's activity during classes when issuing the final grade.
2) Exercise classes:
- solving sample tasks on the blackboard,
- initiating discussions on solutions,
- homework / additional tasks.

Bibliography

Basic:
1. M. Gewert, Z. Skoczylas, Analiza matematyczna 2, Oficyna Wydawnicza GiS, Wrocław 2006.
2. M. Gewert, Z. Skoczylas, Równania różniczkowe zwyczajne, Oficyna Wydawnicza GiS, Wrocław 2005.
3. W. Krysicki, L. Włodarski, Analiza matematyczna w zadaniach, cz.1, cz.2, Wydawnictwo naukowe PWN, Warszawa 2010.
4. Morchało J., Ratajczak Z., Werbowski J., Równania różniczkowe w zastosowaniach, Wydawnictwo Politechniki Poznańskiej, Poznań 1995.

Additional:
1. Banaś J., Wędrychowicz S., Zbiór zadań z analizy matematycznej, Wydawnictwo WNT, Warszawa 1996.
2. Fichtenholz G. M., Rachunek różniczkowy i całkowy, Wydawnictwo naukowe PWN, Warszawa 1986.
3. Foltyńska I., Ratajczak Z., Szafrański Z., Matematyka dla studentów uczelni technicznych, cz.1, cz.2, cz.3, Wydawnictwo Politechniki Poznańskiej, Poznań 2004.
4. Stankiewicz W., Wojtowicz J., Zadania z matematyki dla wyższych uczelni technicznych, cz.1, cz.2, Wydawnictwo naukowe PWN, Warszawa 2003.

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	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)	63	2,50