COURSE DESCRIPTION CARD - SYLLABUS

Course name

Functional Analysis

Course

Field of study

Mathematics in Technology

Year/Semester

3/5

Area of study (specialization)

Profile of study

general academic

Level of study

First-cycle studies

Course offered in

Polish

Form of study

full-time

Requirements

elective

Number of hours

Lecture

30

Laboratory classes

Other (e.g. online)

Tutorials

15

Projects/seminars

Number of credit points

4

Lecturers

Responsible for the course/lecturer:

Prof. dr hab. Ryszard Płuciennik

Responsible for the course/lecturer:

Prerequisites

Basic knowledge in domain of calculus and topology on the level of studies of the first-cycle. Ability to use basic notions of topology, in particular topological spaces, metric spaces, convergence of sequences in these spaces and continuity of functions.

Course objective

In-depth knowledge of functional analysis from scratch. Gaining the ability to apply the acquired knowledge to theoretical as well as practical issues in other fields of mathematics and physics.

Course-related learning outcomes

Knowledge

Knowledge of the most important theorems of functional analysis and their proofs. Understanding how to use the functional analysis to other fields of mathematics with particular emphasis on linear algebra and topology.

Skills

Ability to use notions of linear spaces, vectors, linear operators, norm of operators, linear functionals.

Ability to use these concepts for proving of various properties of linear spaces. Explanation of the meaning of geometric interpretation of these notions and and using other tools of functional analysis.

Social competences

Ability to precise formulation of mathematical problems and trying of solving them. Ability to search for information single-handedly in literature, also in English.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture

Valuation of knowledge and skills during written test.

Practical Lessons

Two large tests concerning an application of knowledge from the lectures in exercises (student can use his own notes)

Systematic control of theoretical knowledge in form of short quizes.

Valuation of student answers during lessons.

Valuation of activity during lessons.

Programme content

Basic topological notions necessary to understand functional analysis. Baire theorem and its applications. Normed and Banach spaces. Examples of such spaces. Hölder Inequality and Minkowski Inequality. Linear operators and linear functionals. Norm of a linear operator and its properties. Riesz Theorem on compactness of a ball. Sequences of linear and continuous operators – Banach-Steinhaus Theorem. An application of Banach-Steinhaus Theorem to classical analysis. Hahn-Banach Theorem and its application. Representation theorems for linear and continuous functional in concrete function or sequence spaces.

Teaching methods

Lecture:

1. The lecture conducted in an interactive way with formulating questions for a group of students or for selected students.

2. The theory presented in relation to the current knowledge of students.

3. Student activity during classes is taken into account when the final grade is considered.

Tutorials:

1.Solving sample tasks on the board.

2. Detailed reviewing of task solutions and discussions with comments.

3.Initiating discussions on solutions.

Bibliography

Basic

1. J. Musielak, Wstęp do analizy funkcjonalnej, Warszawa PWN 1989.

2. S. Prus, A. Stachura, Analiza funkcjonalna w zadaniach, Warszawa PWN 2007.

3. M. Fabian, P. Habala, P. Hajek, V. Montesinos Santalucia, J. Pelant, V. Zizler, Functional Analysis and Infinite-dimensional Geometry, Springer Verlag 2001.

Additional

1. W. Rudin, Analiza funkcjonalna, Warszawa PWN 2011.

2. R.E. Megginson, An Introduction to Banach Space Theory, Springer Verlag 1998.

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,0
Classes requiring direct contact with the teacher	45	2,0
Student's own work (literature studies, preparation for tutorials, preparation for tests and the final test for lectures) [1]	55	2,0

[1] delete or add other activities as appropriate