COURSE DESCRIPTION CARD - SYLLABUS

Course name
Introduction to approximation theory

Course

Field of study
Mathematics in Technology

Year/Semester
4/7

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	Laboratory classes	Other (e.g. online)
30	-	-
Tutorials	Projects/seminars	
15		

Number of credit points

4

Lecturers

Responsible for the course/lecturer:
dr Zbigniew Walczak

Responsible for the course/lecturer:

Prerequisites

Basic knowledge of mathematical analysis and diferential equations. Using of basic notions and methods of mathematical analysis and diferential equations. Student has a ability to think logically. Student is aware of the need to expand their competences. He understands the need for learning.

Course objective

Familiarizing students with various aspects of approximation theory and its applications, and general problems of this division of mathematics.

Course-related learning outcomes

Knowledge

• student knows the object of approximation theory and basic types of problems;

• student knows basic approximation theorems in spaces of continuous functions;

• he knows basic methods of approximation of functions by algebraic polynomials and trigonometric polynomials and their applications.

Skills

• student can use knowledge of higher mathematics;

• student is able to determine convergence or divergence of sequences and series (Advanced Level); he solves problems using estimation;

• student is able to solve problems using basic approximation methods and approximation theorems.

Social competences

• student is aware of the level of their knowledge in relation to research in exact and technical sciences;

• student is aware of the deepening and expansion of knowledge to solve newly created technical problems.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures:

assessment of knowledge and skills demonstrated in the written exam. The exam is assessed in a point system. The condition of passing the exam is obtaining at least 50% of points.

Tutorials: two written assignments carried out under the teacher's supervision. The condition of receiving a positive grade from tutorials is obtaining at least 50% of points. Additional points can be obtained for activity during classes.

Programme content

Update: 01.09.2021r.

Lectures:

• continued fractions and approximation;

• remarks on convergence of series (some tests for convergence of series, approximating sums of series);

• selected applications of power series;

• basic problems in approximation theory of functions (existense and uniqueness of best approximations, Chebyshev sets, modulus of continuity and Lipschitz spaces);

• classical Weierstrass's theorems and generalizations of Weierstrass's theorem;

• Korovkin type approximation theorems;

• approximation of functions by algebraic polynomials;

• approximation of functions by trigonometric polynomials (Fourier series of function on general interval, convergence of Fourier trigonometric series, properties of Fourier coefcients, Fourier and Fejér operators, de la Vallée Poussin means and applications of Fourier series);

• matrix and continuous summability methods of series.

Tutorials:

• continued fractions and approximation;

• remarks on convergence of series (some tests for convergence of series, approximating sums of series);

• selected applications of power series;

• basic problems in approximation theory of functions (existence and uniqueness of best approximations, Chebyshev sets, modulus of continuity and Lipschitz spaces);

• Korovkin type approximation theorems;

• approximation of functions by algebraic polynomials;

• approximation of functions by trigonometric polynomials (Fourier series of function on general interval, convergence of Fourier trigonometric series, properties of Fourier coefcients, Fourier and Fejér operators, de la Vallée Poussin means and applications of Fourier series).

Teaching methods

Lectures:

mulimedia presentation accompanied with examples presented on the blackboard and with questions to the group of students;

Tutorials: solving problems on the board, initiating discussion about the solutions.

Bibliography

Basic

• R. A. DeVore, G. G. Lorentz, Constructive Approximation, Springer -Verlag, Berlin 2006.

• G. M. Fichtenholz, Rachunek różniczkowy i całkowy, PWN, Warszawa 2017.

• W. Narkiewicz, Teoria liczb, Wydawnictwo Naukowe PWN, Warszawa 200.

• S. Łojasiewicz, Wstęp do teorii funkcji rzeczywistych, PWN, Warszawa 1972.

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

Additional

• W. Pleśniak, Wykłady z teorii aproksymacji, Wydawnictwo UJ, Kraków 2000.

• E. W. Cheney, Introduction to Approximation Theory, AMS Chelsea Publishing, Providence, Rhode Island 2000.

• W. Ł. Daniłow, A. N. Iwanowa, J. K. Isakowa, L. A. Lusternik, G. S. Salechow, A. N. Chowanski, L. J. Cław, A. R. Jampolski, Funkcje, granice, szeregi, ułamki łańcuchowe, PWN, Warszawa 1970.

• K. Knopp, Szeregi nieskończone, PWN, Warszawa 1956.

• R. Taberski, Aproksymacja funkcji wielomianami trygonometrycznymi, Wydawnictwo Naukowe UAM, Poznań 1979.

• J. Niedoba, W. Niedoba, Równania różniczkowe zwyczajne i cząstkowe, AGH, Uczelniane Wydawnictwo Naukowo-Dydaktyczne, Kraków 2001.

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,0
Classes requiring direct contact with the teacher	52	2,0
Student's own work (literature studies, preparation for tutorials, preparation for tests nad exam) [1]	48	2,0

[1] delete or add other activities as appropriate