

# Title: Functional equations and inequalities

STATUS: OPTIONAL A

STRUCTURE : Lectures

CLASS HOURS: 30

GRADING: E

ECTS : 3

SEMESTER 2

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LECTURER

prof. dr hab. Janusz Matkowski

PRE-REQUISITES

Basis knowledge from the theory of real functions

COURSE OBJECTIVES (LEARNING OUTCOMES)

The student will possess some knowledge of the method of fixed point in the iterative functional equations.

COURSE CONTENT

Fixed point and Iterations, the Szarkovskij order of positive integers, Szarkovskij theorem; Schauder principle; Banach' principle; contractive mappings, nonexpansive mappings in uniformly convex Banach spaces and Browder-Goede-Kirk fixpoint theorem; nonlinear contractions (Boyd-Wong theorem, Meir-Keeler theorem, etc.); linear inequalities and contractions in product metric spaces.

Iterative functional equations - general solutions (also general solutions in different classes of functions Caratheodory' theorem on the measurability of composition of functions and measurable solutions;  $L^p$  solutions, continuous solutions, continuously differentiable solutions, "dependence of a solution on an arbitrary function").

Results on existence and uniqueness of a solution in some Banach function spaces, with applications the fixed point methods ( $L^p$ -solutions, continuous solutions, BV-solutions, Lipschitzian solutions, differentiable solutions, analytic solutions.

Analytic solutions of the Schroeder functional equation, Siegel set, Montel families of iterates, Fatou set, Julia set.

Systems of iterative functional equations.

Discussion of the possibility of applications of some fixed point methods. Linear equations.

LITERATURE

1. M. Kuczma, Functional equations in a single variable, Monografie Matematyczne 46, Polish Scientific Publishers, Warsaw, 1968.

2. M. Kuczma, B. Choczewski, R. Ger, Iterative functional equations, Encyclopedia of Mathematics and Applications, Cambridge University Press, 1990.

3. J. Dugundji, A. Granas, Fixed point theory, Monografie Matematyczne 61, Polish Scientific Publishers, Warsaw, 1982.

ASSESSMENT  
examination