Obuda University John von Neumann Faculty of Informatics			**Institute of Applied Mathematics**	
Name and code: *Critical points and applications*			**Credits*:*** *2022/23 year I. semester*	
Subject lecturers: Prof. dr. habil. Alexandru Kristály				
Prerequisites (with code):	Calculus I, II			
Weekly hours:	Lecture:	Seminar.:	Lab. hours:	Consultation:
Way of assessment:				

Course description:

Goal: To provide an insight into the theory of critical points and its applications.

Course description: Several mathematical problems can be reduced to the study of critical points of a certain energy functional. During the course we provide a quite complete picture about this theory, showing both theoretical aspects and applications in partial differential equations (PDEs) and differential geometry.

Lecture schedule

Education week	*Topic*
1.	Motivation to study critical points
2.	Deformation lemmas
3.	Morse theoretical approach to critical points
4.	Mountain pass theorem and Palais-Smale condition
5.	Application: elliptic PDEs on bounded domains
6.	Principle of symmetric criticality and Strauss lemma
7.	Rubic actions and elliptic PDEs on unbounded domains
8.	Nonsmooth critical points and differential inclusions
9.	Variational inequalities
10.	Application: subcritical PDEs
11.	Application: sublinear PDEs
12.	Application: elliptic PDEs with oscillations
13.	Critical points on non-flat structures
14.	Open problems and perspectives in critical points

Midterm requirements

Education week	*Topic*

Final grade calculation methods

Achieved result	Grade
89%-100%	excellent (5)
76%-88<%	good (4)
63%-75<%	average (3)
51%-62<%	satisfactory (2)
0%-50<%	failed (1)

2022. 06. 09.

Type of exam
Project presentation & Written exam
Type of replacement
Project presentation
References
Mandatory: 1. Costea N, Kristály A, Varga C, *Variational and Monotonicity Methods in Nonsmooth Analysis*, Frontiers in Mathematics, Birkhäuser/Springer, 2021. 2. Kristály A., Radulescu V., Varga Cs., *Variational Principles in Mathematical Physics, Geometry, and Economics*, Cambridge University Press, Enciclopedia of Mathematics and its Applications. No 136, 2010. 3. Willem M., *Minimax theorems*. Progress in Nonlinear Differential Equations and their Applications, 24. Birkhäuser Boston, Inc., Boston, MA, 1996.
Recommended: 1. Gasiński L., Papageorgiou N., *Nonsmooth critical point theory and nonlinear boundary value problems.* Series in Mathematical Analysis and Applications, 8. Chapman & Hall/CRC, Boca Raton, *FL*, 2005. 2. Kristály A., Moroşanu Gh., New competition phenomena in Dirichlet problems. *J. Math. Pures Appl*. (9) 94 (2010), no. 6, 555–570. 3. Kristály A., Infinitely many solutions for a differential inclusion problem in R*N*. *J. Differential Equations* 220 (2006), no. 2, 511–530.