# Universitatea Babeş-Bolyai

*Universitatea Babeş-Bolyai*
*Facultatea de Matematică şi Informatică*
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Cluj-Napoca,
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**Nonlinear Applied Analysis (Course: 2, Seminar: 1, Examination: during the semester)**

**Contents**

Chapter 1: Contraction principle and applications; Qualitative properties of the fixed point set/fixed point problem;
Chapter 2: Generalizations of the contraction principle and applications;
Chapter 3: Caristi's theorem, Graph contraction principle;
Chapter 4: Picard and weakly Picard operators. Examples;
Chapter 5: A characterization theorem for weakly Picard operators; Abstract Gronwall lemma. Comparison theorems;
Chapter 6: Introduction to multi-valued operator analysis;
Chapter 7: $K^2M$ principle and applications;
Chapter 8: Topological fixed point theorems. Schauder's theorems and applications.

• **Evaluation:** during the semester: two written tests (WT1, WT2), the evaluation of the home-works (H-W) and seminar activity (SA).

• The schedule for the two written tests: First written test (WT1): April 9, 2025, Second written test (WT2): May 28, 2025.

• The home-works must be submitted until May 28, 2025, at the latest.

• **Final mark** $FM$

- $FM := 40\%WT1M + 40\%WT2M + 20\%(H - WM + SAM)$.

• **References**

1. A. Granas, J. Dugundji: Fixed Point Theory, Springer-Verlag, Berlin, 2003.

2. E. Zeidler: Nonlinear Functional Analysis and its Applications. I. Fixed-point Theorems, Springer-Verlag, New York, 1986.

3. R.P. Agarwal, M. Meehan, D. O'Regan: Fixed Point Theory and Applications, Cambridge Univ. Press, 2001.

4. W.A. Kirk, B. Sims (eds.): Handbook of Metric Fixed Point Theory. Kluwer Acad. Publ., Dordrecht, 2001.

5. A. Petruşel : Operatorial Inclusions, House of the Book of Science, Cluj-Napoca, 2002.

6. I.A. Rus: Generalized Contractions and Applications, Cluj University Press, 2001.

• **Important notes**

1) The course and the seminar will take place every Wednesday from 17.00 in Mathematica building, room e;

2) Office hours: Thursday from 8.30-10.00 a.m., by appointment (E-mail: adrian.petrusel@ubbcluj.ro)

3) The two written tests cannot be recovered;

4) It is forbidden to transfer the home-works to the colleagues. In that case, both (all) of the home-works will not be considered;

5) In order to pass the exam every student need to have at least 10 participation at the seminar;