

Nonlinear Functional Analysis and Applications (L24)

Non-Examinable (Graduate Level)

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In these self-contained lectures I will introduce and develop some of the basic analytical tools in nonlinear functional analysis. The main focus will be on the implementation of these methods in investigating and solving certain nonlinear problems, with emphasize on nonlinear partial differential equations. The course will be useful to all students with interest in nonlinear analysis, applied and computational mathematics, and differential geometry.

Topics to be covered:

1. Review of Basic Function Spaces.
2. Some Fixed Point Theorems.
3. Galerkin Method.
4. Monotone Iterations and Monotone Operators.
5. Differential Calculus in Banach Spaces.
6. Variational Methods
7. Palais-Smale Condition and Mountain Pass Lemma
8. Pohozaev's Identity

Pre-requisites

This course expects students to know Real Analysis and basic Linear Functional Analysis.

Literature

1. E. Zeidler, *Nonlinear Functional Analysis and its Applications, Parts I, II, III*. Springer-Verlag.
2. S. Kesavan, *Nonlinear Functional Analysis and its Applications: A First Course*. Hindustan Book Agency (India), 2004.

Additional comments

This will be non-examinable graduate course. However, PhD students might choose to have an oral exam if they wish. There will be no examples sheets associated with this course. Nonetheless, some problems will be given once in a while for those who are interested to have hands on the material, in particular PhD students who choose to have an oral exam.