Evolution Equations and Applications

- **Lecturer:** Gheorghe Morosanu
- **No. of credits:** 3, and no. of ECTS credits: 6
- **Time period of the course:** Fall Term of AY 2014-2015
- **Prerequisites:** Real and Complex Analysis, Functional Analysis
- **Course level:** PhD
- **Brief introduction to the course:**
  After a short historical introduction, the most important results will be presented, including the Hille-Yosida theorem, as well as the main existence results for linear and nonlinear evolution equations. Some applications will be discussed to illustrate the theoretical results.
- **The goals of the course:**
  The main goal of the course is to introduce students to the main topics and methods of the theory of evolution equations in Banach spaces.
- **The learning outcomes of the course:**
  Students will learn some basic methods, which are useful not only for pure mathematicians, but also for applied mathematicians, engineers, physicists. Even more, they will learn how to use these methods in solving specific problems associated with various partial differential equations.
- **More detailed display of contents (week-by-week):**
  1. Preliminaries of linear and nonlinear functional analysis
  2. Uniformly continuous and strongly continuous semigroups of linear operators. Definitions, examples, properties
  3. The Hille-Yosida theorem
  4-5. Solving linear evolution equations by the semigroup approach. Applications to linear partial differential equations
  6. Monotone operators. Minty’s theorem on maximality, surjectivity, perturbation results
  7. Subdifferentials of convex functions
  8. Existence and uniqueness for some evolution equations associated with monotone operators
  9. Existence theory for the case of evolution equations associated with subdifferentials
  10. Stability of solutions, asymptotic behavior
  11-12. Applications to nonlinear parabolic and hyperbolic partial differential systems.

**Books:**

**Teaching format:** lectures combined with classroom discussions

**Assessment:**
- **Attendance** is mandatory.
- **Homework:** will be assigned regularly.
- **Grading:** will be based on homework, participation in classroom discussions, presentations and a final oral or written exam.

**Office hours:** by appointment.

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