Frédéric ROBERT
Phone: +33(0)3.83.68.45.24.
Email: frederic.robert@univ-lorraine.fr

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To:

Adriano Tomassini, Chair

Summer course in SMI Perugia: Functional Analysis

Abstract:
One of the aims of Functional Analysis is to develop general tools on linear and/or topological spaces to tackle practical applications in Analysis. This class will be devoted to a study of some selected topics in the field. In the last part, some applications to the variational formulation and resolution of partial diffferential equations will be given.

Below is a tentative table of content. Depending on the audience and its expectations, some topics will eventually be shortened, others will be more furnished. There will be a strong connection between the lectures and the problems sessions.

Part I: Continuous fonctions

1. Picard's fixed point theorem
2. Stone-Weierstrass and density
3. Ascoli's compactness theorem

Part II: Baire spaces and Convexity

1. Baire's lemma and applications
2. Hahn-Banach's Theorems and applications

Part III: Continuous linear functions

1. Hilbert spaces

2. Weak topology
3. Fourier Transform

Part IV: Sobolev spaces and applications to elliptic PDEs

1. Dimension 1 and main properties
2. Applications to 1D boundary value problems
3. Higher dimensions and applications

Prerequisite:

Topology (especially of metric spaces), Topology of linear normed spaces including projection on convex in Hilbert spaces, Differential Calculus, Integration. Some reminders will be given during the lectures.

References:

Brezis "Functional Analysis: Sobolev spaces and partial differential equations" (Universitext), Rudin "Functional Analysis" (McGraw-Hill).

Institut Elie Cartan - Laboratoire de Mathématiques
Faculté des Sciences et Technologies - B.P. 70239 - 54506 Vandoeuvre-lès-Nancy Cedex - France
Secrétariat : 03 72 74 79 27 - Télécopie : 03 72 74 53 90