Title: Applied Functional Analysis

Instructor: Shankar Venkataramani

Description: Many problems of current interest in a variety of disciplines -- Physics, Geoscience and Material science for example, involve complex systems and phenomena that span a wide range of spatial and temporal scales. These systems are a rich source for interesting mathematical problems, and rigorous analysis has a key role in the study of these systems. This course will explore some of the mathematical questions that arise in the modeling, analysis and computation of multiple scale behavior, using examples from the applied sciences as case studies.

The class will be self-contained and include a quick review of the necessary Functional analysis. Some of the problems that will be considered include Homogenization of heterogeneous media; Pattern formation driven by energy minimization; Convex and non-convex variational problems; Dynamics and nonlinear evolution equations.

Prerequisites/background: Math 523 A and B or Math 527 A and B; Math 528 A or Math 528. Some familiarity with the theory of PDEs will be helpful, although is not necessary.

Texts: There is no required text. We will draw on material from:

(1) Functional Analysis, Sobolev Spaces and Partial Differential Equations, Haim Brezis.

(2) Weak Convergence Methods for Nonlinear Partial Differential Equations, Lawrence C. Evans

(3) An Introduction to Homogenization, Doina Cioranescu and Patrizia Donato .