Math 529-001 - Hermi

Introduction to the Analysis and Geometry of Markov Diffusion Operators

Course Description: Semigroups are a tool of Functional Analysis central to the study of time evolution phenomena and Dynamical Systems. The course focuses on the part of Semigroup Theory related to Markov diffusion semigroups with topics geared towards understanding the interplay of heat spectral bounds, functional inequalities of Sobolev-type and various bounds on solutions of evolution equations linked to geometric properties of manifolds. The course, aimed at graduate students of mathematics, physics, and engineering, will cover the following topics:

- Markov processes and associated semigroups: Model examples
- Dirichlet forms and spectral decomposition
- Symmetric Markov diffusion operators
- Model functional inequalities: Poincaré, Log-Sobolev, and Sobolev inequalities
- Related Functional, Isoperimetric, and Optimal Transportation Inequalities
- Gaussian concentration inequalities, and related entropy estimates.

Textbook(s): Analysis and Geometry of Markov Diffusion Operators, by Dominique Bakry, Ivan Gentil, and Michel Ledoux, Springer 2014; available online here:
http://link.springer.com/book/10.1007/978-3-319-00227-9

We will also refer to original papers whenever arguments are simpler to present.

Prerequisites: Core Math or Applied Math. Courses; some knowledge of PDEs, Dynamical Systems, and Probability Theory is recommended but is not required.