MATH 595: TOPICS IN OPERATOR ALGEBRAS
SPRING 2013

Instructor: Michael Brannan, 376 Altgeld Hall.
Lectures: Tuesday and Thursday 11:00 - 12:30, Henry Building 149.

Much of the theory of operator algebras is motivated by results and examples arising in group theory. The aim of this course is to introduce students to various topics in operator algebras of current interest, and to motivate these topics using concrete examples coming from group (representation) theory. A large part of this course will be devoted to studying approximation properties for groups and manifestations of these properties in terms of operator algebras associated to groups. Our emphasis will be on von Neumann algebraic aspects.

Topics covered in this course may include, but are not necessarily limited to, the following:

- Basic properties and notions from $C^\ast$-algebra and von Neumann algebra theory.
- Groups, representations and operator algebras associated to them.
- Amenable groups: Relations to nuclearity, injectivity, hyperfiniteness, semi-discreteness.
- Other approximation properties for groups and operator algebras: a-T-menability, weak amenability, exactness, Kazhdan’s property (T), applications to rigidity results for $\text{II}_1$-factors.
- Free products and related constructions.
- Structure of type III von Neumann algebras: Weights, modular theory, crossed products, Tomita-Takesaki theory.

Prerequisites: Graduate standing, or permission of the instructor.

References: There will be no required textbook. Some good general references include “$C^\ast$-algebras and finite dimensional approximations” by N.P. Brown and N. Ozawa, “Fundamentals of the theory of operator algebras” (Volume 2) by R. Kadison and J. Ringrose, and “Theory of Operator Algebras” (Volumes 1-3) by M. Takesaki.