

# Math 6395: Topics in $C^*$ -algebras

**Instructor:** Dr. Mark Tomforde

**Office:** 601 PGH

**Email:** *see my website*

**URL:** [www.math.uh.edu/~tomforde](http://www.math.uh.edu/~tomforde)

**Office Hours:** (*by appointment*) You are welcome to come see me to discuss the course or the material. To make an appointment, send me an email.

**Meeting Times:** Lecture: MWF 10:00 – 11:00AM in 345 PGH. (There will be no class the week of Jan. 28–Feb. 1, because I will be out of the country.)

**Prerequisites:** A course in Functional Analysis and Operator Theory, a course in Abstract Algebra covering rings and modules, and some basic knowledge of the Functional Calculus.

**Course Description:** We will cover a variety of topics in  $C^*$ -algebra theory. The goal is to expose students to the fundamentals used in current areas of active research, and to examine a number of examples that illustrate different aspects of the theory.

A few topics that I hope to cover are . . .

- homomorphisms, ideals, quotients, uniqueness of norm, characterization of general and commutative  $C^*$ -algebras, representations and the GNS construction
- unitizations and the multiplier algebra
- AF-algebras and matrix units, Bratteli diagrams, UHF algebras, supernatural numbers
- crossed products by  $\mathbb{Z}$
- tensor products, nuclearity, stabilization
- $C^*$ -modules, Morita equivalence, corners of  $C^*$ -algebras
- the Toeplitz algebra and Coburn's theorem
- isometries and the Cuntz algebras
- left ideals, hereditary subalgebras, purely infinite  $C^*$ -algebras

- partial isometries, graph  $C^*$ -algebras
- gauge-invariant uniqueness, gauge-invariant ideals
- $K$ -theory, the classification program for  $C^*$ -algebras

**Colloquia:** You should plan on attending the following two colloquia, which will be relevant to the material we are discussing in this course.

- February 20, 3–4PM in 204 SEC, Gene Abrams will be speaking on Leavitt Path Algebras, which are closely related to graph  $C^*$ -algebras.
- April 16, 3–4PM in 204 SEC, Paul Muhly will be speaking on  $C^*$ -algebras and Operator Algebras

**Texts:** There is no official textbook for this course. A few books that may be useful references are:

## References

- [1] G. J. Murphy,  $C^*$ -algebras and Operator Theory, Academic Press, San Diego, 1990. (*This book is a good introduction to the basics of  $C^*$ -algebras.*)
- [2] K. Davidson,  $C^*$ -algebras by Example, Fields Institute Monographs, vol. 6, Amer. Math. Soc., Providence, 1996. (*This book contains a careful examination of some useful classes of  $C^*$ -algebras.*)
- [3] I. Raeburn and D. P. Williams, Morita Equivalence and Continuous-Trace  $C^*$ -Algebras, Math. Surveys & Monographs, vol. 60, Amer. Math. Soc., Providence, 1998. (*This book has an excellent treatment of  $C^*$ -modules and Morita equivalence. The appendices also contain useful information about the fundamentals of  $C^*$ -algebras.*)
- [4] N. E. Wegge-Olsen,  $K$ -theory and  $C^*$ -algebras, Oxford University Press, Oxford, 1993. (*In addition to an introduction to  $K$ -theory, this book has a good introduction to many topics in  $C^*$ -algebra theory.*)

**Special Needs:** Any student with a disability or chronic health problem for whom special accommodations would be helpful is encouraged to discuss with the instructor the types of assistance that might be offered.