

**PMath 810
Operator Algebras**

**Course Outline
January 2021**

Instructor: Laurent W. Marcoux

MC 5014

Chapter One: **A review of the main theorems from Banach spaces**

Chapter Two: **Banach algebras**
1. Basic theory
2. The functional calculus
3. Relative spectra

Chapter Three: **Operator algebras**
1. The algebra $\mathcal{B}(\mathfrak{X})$, \mathfrak{X} a Banach space
2. The algebra $\mathcal{B}(\mathcal{H})$, \mathcal{H} a Hilbert space
3. Compact operators

Chapter Four: **Commutative Banach algebras**
1. The Gelfand transform
2. Examples
3. The Jacobson radical

Chapter Five: **C*-algebras**
1. Definitions and Basic Theory
2. Elements of C*-algebras
3. Ideals in C*-algebras
4. The GNS Construction

Chapter Six: von Neumann algebras
1. An introduction
2. The Spectral Theorem for normal operators

Grading. To be determined.

There is no specific text for the course, although I shall be making a typed version my notes available to you online. A preliminary version of these notes is currently available on my UW website: <https://www.math.uwaterloo.ca/~lwmarcou/>.

I do expect students taking this course to be familiar with the main results of Functional Analysis (i.e. the material from PMath 453/753). My notes for *that* course are available on the same website.

Some other textbooks which may be helpful for PMath 810 are:

Murphy, G.J., *C*-algebras and Operator Theory*, Academic Press, 1990.

Douglas, R., *Banach algebra techniques in operator theory*, Academic Press, 1972.

Kadison, R. and Ringrose, J., *Fundamentals of the theory of operator algebras*, Academic Press, 1983.

Rudin, W., *Functional Analysis*, McGraw-Hill, 1977.

Takesaki, M., *Theory of operator algebras*, Springer Verlag, 1979.