DEPARTMENT OF MATHEMATICS VANDERBILT UNIVERSITY

FALL SEMESTER, 2003

Math 362A, Functional Analysis **Dietmar Bisch**

TuTh, 9:35-10:50 am, SC 1424

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Prerequisites: Basic real analysis (i.e. the equivalent of a first year graduate course in real analysis), including point set topology. Basic linear algebra.

Syllabus: The course will start off with a discussion of the basic principles of functional analysis such as the Hahn-Banach theorem, the open mapping theorem and the uniform boundedness principle. These are fundamental theorems which are used in various areas of mathematics such as applied analysis, representation theory, operator theory, operator algebras and noncommutative geometry.

In the next part of the course we will discuss basic Hilbert space techniques. These techniques play an important role in applications as for instance in approximation theory, quantum mechanics and in the theory of wavelets. We will then prove elementary facts about bounded operators on Hilbert space, including compact and Fredholm operators. If time permits, we will present the spectral theorem for normal operators on Hilbert space, which leads to the so-called Borel functional calculus. Depending on time and interests of the participants, applications to unbounded operators and operator algebras will be discussed.

It is strongly recommended that those who want to continue in the spring semester 2004 with Guoliang Yu's course on noncommutative geometry take this course.

Grading: There will be no exams. The course grade will be based on attendance, homework problems and a presentation during class on a topic relevant to the course. Homework problems will be discussed in the discussion section (Thursdays 11:00am-12:00pm in SC 1403).

Recommended literature: There will be no textbook. The following books contain part of what I plan to cover in the course (most books on functional analysis will do):

1) John B. Conway, *A Course in Functional Analysis*, Springer GTM 96, 2nd edition (January 1997).
2) Barry Simon and Stephen Reed, *Functional Analysis*, Academic Press, 1997, 2nd edition.
3) Gert Pedersen, *Analysis Now*, Springer Verlag, GTM 118, 1988 (revised edition).