This course looks at the question:

- What’s the best way to approximate a given function by “good” functions, such as polynomials or sums of trigonometric functions?

The search for the precise meaning of “best” leads to the idea of a spaces of functions, and most prominently, the function spaces known as Hilbert spaces. We will combine a study of the fundamentals of Hilbert spaces, harmonic analysis (e.g., Fourier series), and operator theory, with applications including:

- Solving the heat equation, the wave equation, and Schrödinger’s equation
- An introduction to the math of quantum mechanics
- Other topics, chosen to match student interests

We will assume students are familiar with the fundamental ideas of calculus and analysis I (sequences, limits, continuity, differentiation, integration, series); the point of this course is to see how that theory is used. The course will also be well-suited to master’s students who want to review analysis, but also want to learn something new and look into interesting topics for thesis work.

**Prerequisites:** Math 131A (Introduction to Analysis), equivalent course, or instructor permission.

**Text:** The primary text will be course notes written by the instructor and freely available online.