**Course No.:** Math 542  
**Course Title:** Fourier Analysis  
**Core Course:** YES  
**Term:** Winter 2018

**Instructor:** Bin Han, CAB 541, bhan@ualberta.ca, http://www.ualberta.ca/~bhan

**Outline:**

Fourier transforms have been widely and successfully employed in pure/applied mathematics, engineering, computer science, and industry. The goal of the course is to introduce the basic mathematical theory of Fourier analysis on $\mathbb{R}^d$, with focus on results that are widely applicable and useful in theory and applications.

**Short Preliminaries:** some important results and inequalities from real analysis.

**Fourier Series:** Fourier series of integrable and square integrable functions, orthonormal systems, Bessel’s inequality, Parseval’s identity, Riesz-Fisher Theorem, summability kernels, Dirichlet and Fejer kernels, absolutely convergent Fourier series, Wiener’s lemma, remarks on point-wise convergence.

**Discrete Fourier Transform (DFT):** Discrete Fourier transform with applications.

**Fourier Transforms:** Fourier transforms in several dimensions, Fourier inversion formula, Poisson summation formula, Plancherel formula, maximal functions, Riesz-Thorin’s interpolation theorem, Schwartz class, tempered distributions, Fourier transform of tempered distributions, distributions.

**Applications of Fourier Analysis to Wavelet Theory:** Shift-invariant spaces, multiresolution analysis, orthogonal wavelets, continuous wavelet transform, sampling theorems, Heisenberg uncertainty principle, Windowed Fourier transform. (Material in this part is optional and is naturally built on Fourier analysis.)

**Textbook(s):** No textbook is required (Course notes will be provided).

Some suggested other books for references:
5. B. Han, Wavelets and framelets, book manuscript.

**Grading:** Assignments 30%,  
Midterm Exam 20%,  
Final Exam 50%.