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 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:

1. Y. Katznelson, An introduction to harmonic analysis, (1976).
2. E. Stein & G. Weiss, Introduction to Fourier analysis on Euclidean spaces, (1971).
3. E. Stein & R. Shakarchi. Fourier analysis: an introduction, (2003).
4. D. Kammler, A first course in Fourier analysis, (2000).
5. B. Han, Wavelets and framelets, book manuscript.

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