Many systems evolve with an inherent amount of randomness in time and/or space. The focus of this course is on developing and analysing methods for analyzing time series. Because most of the common time-domain methods are unreliable, the emphasis is on frequency-domain methods, *i.e.* methods that work and expose the bias that plagues most time-domain techniques. Slepian sequences (discrete prolate spheroidal sequences) and multitaper methods of spectrum estimation are covered in detail with examples from science and engineering problems.

**Textbook:** *Notes and Selected Reading*

(Recommended) *Spectral Analysis for Physical Applications; Multitaper and Conventional Univariate Techniques*


**Prerequisite:** MATH-335* or 338* and MATH-251* or STAT-261* and MATH-312*.

**Instructor:** D. J. Thomson

**Evaluation:**
- Take Home Examination 20%
- Midterm Test 40%
- Assignments 40%

**Outline:**
- Introduction to Time Series
- Review of Fourier Transforms and the FFT
- Prediction Problems and Harmonic Processes
- Stationary Processes and the Spectral Representation
- Classical Spectrum Estimates
- Slepian Sequences
- Multitaper Estimates
- Tests for Periodic Terms
- Bivariate Processes and Coherence
- Design of Data Collection and Analysis Procedures
- Nonstationary Processes and Additional Topics