The focus of this course is to provide Kinesiology students with the tools necessary for data acquisition and signal processing. This course will cover the techniques commonly used in various fields of Kinesiology, including physiology, motor control, neuroscience, biomechanics and motor learning. These techniques include (but are not limited to) sampling theory, Analog-Digital data acquisition, analog and digital filters as well as data analysis techniques. It is assumed that students have an undergraduate background in Kinesiology or related field as well as basic linear algebra and computer skills. Emphasis is placed on laboratory skills, presentation skills and on the development of a research project.

**Objectives:**

1. Develop the background techniques and tools to acquire and analyse research data.
2. Allow students to present their ideas and results on a topic and have these ideas subjected to evaluation and feedback by their peers.
3. Develop and perform a research project for an in-depth learning of the topics discussed in class.

**Expectations:**

Students are required to perform weekly laboratory activities and presentations on topics discussed in class. In addition, they need to prepare for the material to be discussed in the roundtable discussions through proposed readings.
Course Evaluation:

A. Weekly or Bi-Weekly Presentations: 40%

Students will lead a 4-minute presentation on the laboratory techniques learned during the preceding week. During the term, students are required to use at least once their least familiar software for data analysis (Matlab or LabVIEW). (Presentations must be performed in Powerpoint or similar program).

B. Presentation of Research Project: 40%

A 15-20 minute oral presentation of the research project. Students will present their research project with a major emphasis on the laboratory and signal processing techniques necessary to analyse their data. (Presentations must be performed in Powerpoint or similar program).

C. Class participation: 20%

Active class participation is required for the good functioning of the course. Students will be graded based on their preparation of the assigned material and participation to in-class roundtable discussions.

Readings:

Readings will consist of book chapters and original research articles from peer-reviewed journals.

Each week, students will be assigned a set of readings. These readings are intended to provide a background overview of the themes and concepts and must be read in preparation for the seminars. Students will facilitate a roundtable discussion and presentation of the topics covered in the assigned readings.

For week 1, students must bring to class a paper that uses a signal processing technique they intend to learn in this class.

Sample list of recommended readings (more may be added throughout the course as appropriate):

- Smith, SW. The Scientist and Engineer’s Guide to Digital Signal Processing
  http://www.dspguide.com/pdfbook.htm
- LabVIEW Manuals and Help Guides
- Matlab Manuals and Help Guides
- Bendat JS, Piersol AG. Random data analysis and measurement procedures (3rd Ed). Wiley. 2000. 594 pages
University of British Columbia. 2001


- Winter DA. Biomechanics and Motor Control of Human Movement. Wiley. 2009. 384 pages


-
### Schedule

| Week 1 | Course Introduction  
|        | Signal Processing overview and Introduction to Matlab & LabVIEW  
|        | Readings:  
|        | • [https://www.youtube.com/watch?v=7bnVx34yQf4](https://www.youtube.com/watch?v=7bnVx34yQf4)  
| Week 2 | Sampling a continuous time signal and Introduction to analog & digital signals.  
|        | Readings:  
|        | • Van Drongelen W. Signal Processing for Neuroscientists. An introduction to the analysis of physiological signals. Chap 1 & 2  
| Week 3 | Preliminary findings, Tutorial & Discussions on Sampling a continuous time signal and Introduction to analog & digital signals.  
| Week 4 | Synchronization of data from different sources  
|        | Readings:  
| Week 5 | Preliminary findings, Tutorial & Discussions on Synchronization of data from different sources  
| Week 6 | Data analysis, noise & signal averaging  
|        | Readings:  
|        | • Van Drongelen W. Signal Processing for Neuroscientists. An introduction to the analysis of physiological signals. Chap 3 & 4  
| Week 7 | Continuous, discrete and Fast Fourier Transform. Brief overview of correlation in the time and frequency domains.  
|        | Readings:  
|        | • Van Drongelen W. Signal Processing for Neuroscientists. An introduction to the analysis of physiological signals. Chap 5, 6, 7 & 8  
|        | • Smith, SW. The Scientist and Engineer’s Guide to Digital Signal Processing. Chap 5-6-8-9-10 & 12.  

-4-
<table>
<thead>
<tr>
<th>Week 8</th>
<th>Preliminary findings, Tutorial &amp; Discussions on Continuous, discrete and Fast Fourier Transform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 9</td>
<td>Introduction to filters &amp; filter analysis. The RC circuit &amp; Digital filters</td>
</tr>
<tr>
<td></td>
<td>Readings:</td>
</tr>
<tr>
<td>Week 10</td>
<td>Preliminary findings, Tutorial &amp; Discussions on Introduction to filters &amp; filter analysis. The RC circuit &amp; Digital filters</td>
</tr>
<tr>
<td>Week 11</td>
<td>Research Project</td>
</tr>
<tr>
<td>Week 12</td>
<td>Research Project</td>
</tr>
<tr>
<td>Week 13</td>
<td>Research Project</td>
</tr>
<tr>
<td>Week 14</td>
<td>Research Project Presentations</td>
</tr>
</tbody>
</table>