SAMPLE COURSE OUTLINE

Course Code, Number, and Title:

KINS 2370: Data Acquisition and Signal Processing

Course Format:
[Course format may vary by instructor. The typical course format would be:]

Lecture 2 h + Seminar 0 h + Lab 2 h

Credits: 3 **Transfer credit:** For information, visit bctransferguide.ca

Course Description, Prerequisites, Corequisites:

An introduction to data acquisition and signal processing, with applications to kinesiology. The role of each component of a typical data acquisition system will be described. Basic sampling theory and filtering will be covered, and reinforced with laboratory activities. Common pitfalls in data acquisition will be discussed, including aliasing, quantization, clipping, and noise. Students will work in the MATLAB computing environment to practice digital signal processing techniques.

Prequisites: Precalculus 11 with "C" grade or higher or MATH 1150 with "C" grade or higher, or MDT 70 or higher or MATH 1152 or MATH 1170 or MATH 1171 or MATH 1153 or MATH 1173.

Corequisites: None

Learning Outcomes:
Upon successful completion of this course, students will be able to:

- Use the MATLAB computing environment at an introductory level;
- Use basic programming tools to perform quantitative operations on large data sets for the purposes of scientific inquiry;
- Debug (i.e. correct) a basic malfunctioning MATLAB script;
- Discuss the ways in which a data acquisition system operates to digitize biological analog signals;
- Use the principles of the Nyquist-Shannon sampling theorem to correctly select a sampling frequency for a given biological signal;
- Discuss the difference between software (i.e. digital) and hardware (i.e. analog) filters;
- Discuss the various types of digital filters and describe a situation in which each type would be used;
- Describe the concept of and procedures for smoothing a digital signal;
- Recognize in a recorded signal common errors in data acquisition, such as quantization, clipping, and 60 Hz noise, and to describe data acquisition procedures that would allow these errors to be avoided;
- Differentiate and integrate a digital signal using numerical methods;

- Discuss the effects on noise of different frequencies of differentiating and integrating using numerical methods.

Instructor(s): TBA
Office: TBA **Phone: 604 323 XXXX** **Email: TBA**

Office Hours: TBA

Textbook and Course Materials:
[Textbook selection may vary by instructor. An example of texts and course materials for this course might be:}

Attaway, S. “MATLAB: A Practical Introduction to Programming and Problem Solving”. Oxford, UK. 2013. Chapters 1, 2, 3, 4, 5, 7, 8.

Simon S Young. “Computerized Data Acquisition and Analysis for the Life Sciences”. New York, USA. 2001. Chapters 1, 2, 3, 4, 5.

Note: *This course may use an electronic (online) instructional resource that is located outside of Canada for mandatory graded class work. You may be required to enter personal information, such as your name and email address, to log in to this resource. This means that your personal information could be stored on servers located outside of Canada and may be accessed by U.S. authorities, subject to federal laws. Where possible, you may log in with an email pseudonym as long as you provide the pseudonym to me so I can identify you when reviewing your class work.*

Assessments and Weighting:
Final Exam 25%
Other Assessments %
(An example of other assessments might be:) %

Midterm Exam: 2 x 20%
Assignments: 35%

Proportion of group and individual work:
Individual: 100%

Grading System: Letter grade
Specific grading schemes will be detailed in each course section outline.

Passing grade: D

Topics Covered:
[Topics covered may vary by instructor. An example of topics covered might be:]

Week 1 - Introduction to the MATLAB computing environment
Week 2 - Programming and Plotting in MATLAB
Week 3 - Selection Statements in MATLAB
Week 4 - Loop Statements and Vectorizing Code in MATLAB
Week 5 - Data Structure: Cell Arrays in MATLAB
Week 6 - Introduction to Transducers (basic electronics, calibration, drift, and hysteresis)
Week 7 - Signals in the Frequency Domain (power spectral density plots, examining the frequency content of biological signals)
Week 8 - The Components of a Data Acquisition System (amplifier, sample-and-hold circuit, analog-to-digital converter)
Week 9 - Sampling Theory (aliasing, Nyquist-Shannon Sampling Theorem, the selection of sampling frequency)
Week 10 - Filters (hardware vs. software filters, signal-to-noise ratio, types of filters, smoothing)
Week 11 - Common Pitfalls in Data Acquisition (quantization, clipping, noise)
Week 12 - Numerical Differentiation and Integration (finite difference method, amplification of noise of specific frequency)

As a student at Langara, you are responsible for familiarizing yourself and complying with the following policies:

College Policies:

E1003 - Student Code of Conduct
F1004 - Code of Academic Conduct
E2008 - Academic Standing - Academic Probation and Academic Suspension
E2006 - Appeal of Final Grade
F1002 - Concerns about Instruction
E2011 - Withdrawal from Courses

Departmental/Course Policies:

This generic outline is for planning purposes only.