Course Objectives
The goal is to introduce biological systems and apply engineering principles (electrical and mechanical) to the solution of the biomedical problems. The emphasis of this course will be both practical and theoretical. You will design systems to acquire biomedical signals in the laboratory and use this data throughout the course.

Prerequisites
ECE 2160 Electronics 2E
ECE 3780 Signal Processing 1

Course Content
The following topics will be covered:
- Special problems and requirements for recording and analyzing biological signals, i.e. ECG, EMG, from human subjects.
- The design of instrumentation amplifiers for analog signal conditioning.
- Examination of possible health hazards associated with measurement of biological signals.
- Study of relevant physiology and anatomy of the physiological systems.
- Analysis of biological signals.

Accreditation Units
Mathematics: 0%
Natural Science: 0%
Complementary Studies: 0%
Engineering Science: 50%
Engineering Design: 50%

Web Page
The Lecture notes, labs and announcements will be posted on the Jump.

Textbook

Other References
1. Lecture notes, which will be available on the course web page and will provide the necessary physiology and anatomy, as well as signal analysis background.
2. *Medical Instrumentation: Application and Design*, John G. Webster, Wiley, 3rd edition. Specifically, the course will cover material from chapters 1, 3, 5, and 6, and some sections of chapters 7, 8, 9, and 14.

Evaluation Details
The final course grade will be determined from a student’s performance in quizzes (25%), lab experiments and assignments (20%), a project (15%), and a final examination (40%). Attendance at lectures is essential to successful completion of this course. To receive a passing grade the student must finish all the components of the course.

Instructor
TBA
Office Hours
TBA

Teaching Assistant
TBA

Voluntary Withdrawal Date
Wednesday, November 12th, 2014.

Requirements/Regulations

• Attendance at lectures and laboratories is essential for successful completion of this course. Students must satisfy each evaluation component in the course to receive a final grade.

• It is the responsibility of each student to contact the instructor in a timely manner if he or she is uncertain about his or her standing in the course and about his or her potential for receiving a failing grade. Students should also familiarize themselves with Sections 4 and 6 of the Regulations dealing with incomplete term work, deferred examinations, attendance and withdrawal.

• No programmable devices or systems (such as calculators, PDAs, iPods, iPads, cell phones, wireless communication or data storage devices) are allowed in examinations unless approved by the course instructor.

Academic Integrity
Students are expected to conduct themselves in accordance with the highest ethical standards of the Profession of Engineering and evince academic integrity in all their pursuits and activities at the university. As such, in accordance with the General Academic Regulations and Requirements of the University of Manitoba, Section 7.1, students are reminded that plagiarism or any other form of cheating in examinations, assignments, laboratory reports or term tests is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). A student found guilty of contributing to cheating in examinations or term assignments is also subject to serious academic penalty.

Learning Outcomes

1. To be able to build a signal conditioning device for most biological signals
2. To be able to debug and analyze the instrumentation amplifiers
3. To be able to recode and analyze Electromyographic (EMG-muscles’) signals
4. To be able to recode and analyze Electrocephologram (ECG) signals (heart vital signal)
5. To be able to recode and analyze heart, respiratory and swallowing sounds.

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<tr>
<th>Learning Outcome</th>
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Expected Competency Level **
*Attributes:
A1 A knowledge base for engineering
A2 Problem analysis
A3 Investigation
A4 Design
A5 Use of engineering tools
A6 Individual and team work
A7 Communication skills
A8 Professionalism
A9 Impact of engineering on society/environment
A10 Ethics and equity
A11 Economics and project management
A12 Life-long learning

**Competency Levels:**
1 - Knowledge (Able to recall information)
2 - Comprehension (Able to rephrase information)
3 - Application (Able to apply knowledge in a new situation)
4 - Analysis (Able to break problem into its components and establish relationships)
5 - Synthesis (Able to combine separate elements into whole)
6 - Evaluation (Able to judge of the worth of something)

Student Contact Time (Hrs)
Lectures: 3 hrs lecture/week × 13 weeks/term = 39 hrs
Laboratories: 3 hrs laboratory × 5 weeks = 15 hrs
Tutorials: 0 hr tutorial × 0 weeks = 0 hrs

Evaluation

<table>
<thead>
<tr>
<th>Component</th>
<th>Value (%)</th>
<th>Methods of Feedback *</th>
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<td>Assignments and Laboratories</td>
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* Methods of Feedback: F - *formative* (written comments and/or oral discussion), S - *summative* (number grades)