ECE499
Introduction to Bioengineering

Spring 2007.
Class time: Mondays and Wednesdays, 3-4:15pm.
Instructor: Nathalia Peixoto
Office hours: open (to be discussed in class)

Objective: This course gives an overview of Bioengineering. The sequence of classes is designed to cover from fundamentals of Physiology through applications of bioinstrumentation such as EKG, EEG, EMG. Other aspects of Biomedical Engineering to be discussed include the biomechanics, rehabilitation, biomaterials, tissue engineering, bioinstrumentation, sensors and biosignal processing.

Prerequisites: As a technical elective, I expect the students to be committed to learning the subject, and to using engineering tools (Matlab, PSpice, microcontroller knowledge, talent in Electronics) they acquired throughout their first three years of college.

Supplementary texts:

- J Enderle, S Blanchard, J Bronzino, **Introduction to Biomedical Engineering.** Academic Press, 2005. ISBN 0-12-238662-0.
- MM Domach, **Introduction to Biomedical Engineering.** Pearson Prentice Hall, 2004. ISBN 0-13-061977-9.
- SM Dunn, A Contstantinides, PV Moghe, **Numerical Methods in Biomedical Engineering**, Academic Press, 2006. ISBN 0-12-186031-0.
- Khandpur, R.S., **Biomedical Instrumentation**, McGraw-Hill, 2005. ISBN 0071447849.
- Kandel, E.R., **Principles of Neural Science**, McGraw-Hill, 2000, ISBN 0838577016.
- Purves, D, Augustine, G.J, et al. (eds), **Neuroscience**, Sinauer Assoc., 1997 (or newer edition). ISBN 0878937471.
- B. He, **Neural Engineering**, Bioelectric Engineering Series, vol. 3, 2005. ISBN 0-306-48609-1.

Obs. Don't buy any of the supplementary textbooks: they are meant as a guide for you to know which areas the course will cover. Some (if not all) of these books will be on reserve in Fenwick.

Course structure: the course consists of a weekly lecture, a weekly lab, homework, and one exam. The second exam is optional. Students may choose to present an experimental project instead of the final exam. Exams will be closed book and closed notes. Participation in class will be considered as part of the grade; the hope is that most of the sessions will be of great interest to students and arouse discussion in class, in the form of possible projects and ideas in biomedical engineering.

Grade:

Midterm	20%
Final exam and/or project	30%
Participation in class and homework	20%
Lab work	30%

Week	Monday	Lecture	Wed	Activity
1	Jan 22	Anatomy & Physiology	Jan 24	Labview I – clock/loops/basics
2	Jan 29	Cellular physiology	Jan 31	Labview II – file I/O
3	Feb 5	Biomaterials	Feb 7	Labview III – data acq + an.out.
4	Feb 12	Drug Delivery	Feb 14	Labview IV – system integration
5	Feb 19	Tissue engineering	Feb 21	Exp 1
6	Feb 26	Bioinstrumentation	Feb 28	Exp 2
7	Mar 5	Midterm	Mar 7	Exp 3
8	Mar 12	Spring break	Mar 14	Spring break
9	Mar 19	Cardiac physiology	Mar 21	Exp 4
10	Mar 26	ECG	Mar 28	Exp 5
11	Apr 2	Biomechanics	Apr 4	Exp 6
12	Apr 9	The nervous system	Apr 11	Exp 7
13	Apr 16	Action Potentials	Apr 18	Exp 8
14	Apr 23	Rehabilitation	Apr 25	Exp 9
15	Apr 30	Genomics & bio-informatics	May 1	Exp 10
16	May 7	Reading day	May 9	Project presentations
17	May 14	(Exam)		

Each group is expected to work through 5 out of 7 experiments. Each experiment should not take more than two lab classes. One page reports are expected (per group, per experiment). The following is a short description the experiments:

- **AcGlove**: Active glove. Measure pressure from your fingers.
- **EKG**: (electrocardiograph) data acquisition and signal analysis with LabView.
- **EMG**: electromyography. Measure muscle activity and fatigue.
- **ImAcq**: image acquisition with one of (1) pupillometry; (2) eye tracking (3) gait tracking.
- **Neurot**: voice activation of a Mindstorms NXT robotic arm.
- **RespRate**: measure your respiration rate with a MEMS accelerometer.
- **DIY**: do-it-yourself. If you have a good idea for a bio-experiment, come talk to me. [This can be your project, and in that case it will count for 2 experiments.]