BME 6360 – Neural Engineering

Spring 2008 Location: 350 NEB

Catalog Description:
Neural Engineering represents the application of Engineering to neuroscience including such diverse areas as neural tissue engineering, models of neural function, and neural interface technology. This course will focus on these areas primarily in the context of neural interfaces/prosthetics beginning with basic neural physiology and models of neural mechanisms to the advanced neural interfaces currently being developed and or produced commercially by the field. Credits: 03

Prerequisites:
Graduate students only. Programming experience in Matlab will be needed to complete projects in this course. Some signal processing experience will be helpful as well.

Professor:
Dr. Thomas DeMarse
Department of Biomedical Engineering
147 Biomedical Engineering Building
Ph: 352-392-9235 Mobile: 404-384-7707
Email: tdemarse@bme.ufl.edu
http://cortex.bme.ufl.edu/~neuroeng/

Office Hours:
Thursdays after class but please feel free to stop by my office or the lab (Rm 100) anytime.
TA: TBA

Course Objectives:
The overall objective for this course is to introduce students to the field of neural engineering. Neural engineering is an emergent field that combines neurobiology, neuroscience, biomedical engineering, electronics, and instrumentation. This course will consist of a combination of introductory lectures and a problem based learning approach focused on specific problems within the field of neural engineering. Some of these problems will require the use of software tools (e.g., Matlab) and some basic modeling skills.

Topics include:
- Types of neurons, ion channels, cable properties, action potentials
- Modeling Neural Systems
- Neural interfaces, measurement, and stimulation technology
- Neural Prostheses: Current Devices and Research to Treat Neural Dysfunction

Goals:
At the end of the course, students should be knowledgeable in the following areas:

1.1. Basic Neuro-electrophysiology including the demonstrated ability to record and analyze neural activity.
1.2. Familiar with advanced neural interface techniques/technologies
1.3. Be able to conduct rudimentary analysis of neural activity using some standard measures
1.4. Employ software tools (i.e. MATLAB) to support the modeling/analysis

Grading:
Grading for this course will consist of written reports by each student for each of the Reading sets covering various neural engineering topics. Over the course
- 65% of your grade will be based on your written answers to the Problem Sets.
- 5% Individual performance assessment of student presentations (by students) given for readings each week.
- 5% Attendance
- 10% Written Project Report for EOG control - Midterm.
- 15% Written Final Project Report.

| Topic | | |
|-------|------------------|
| Week 1- Neurons, Ion channels, cable properties, action potential. | |
| Week 2- Modeling Neural Systems | Reading Question Set (RQS)#1 Hodgkin and Huxley model of the neuron. |
| Week 3-4 Readings: Brain-machine interfaces (BMI) based on EEG measures | RQS #2 |
| EOG Control Project Assignment | |
| Week 5- Using the Tucker Davis System for EEG Measurement | RQS #3- Individual Work Recording Neural Signals |
| Week 6-7 Readings: Multielectrode Array interfaces for the nervous system | RQS #4 Multi-unit Spike train analysis |
| Midterm Report on EEG Control due | |
| Week 8-9 Readings: Cochlear implants | RQS #5 |
| Final Project Assignment | |
| Week 10-11 Week Readings: Multi-unit recording in retina-Retinal Prosthetics | RQS #6 |
| Week 12 Readings: Neural Patterning for Biocomputation (if time permits) | RQS #7 |
| Week 13-14 Readings: Neural prosthetics/Robotic/computer control - using multielectrode array technology. | RQS #8 |
| Exam week- Written Final Project Due and demonstration of your technology/technique | |

**Academic Honesty:**

In adopting this Honor Code, the students of the University of Florida recognize that academic honesty and integrity are fundamental values of the University community. Students who enroll at the University commit to holding themselves and their peers to the high standard of honor required by the Honor Code. Any individual who becomes aware of a violation of the Honor Code is bound by honor to take corrective action. A student-run Honor Court and faculty support are crucial to the success of the Honor Code. The quality of a University of Florida education is dependent upon the community acceptance and enforcement of the Honor Code. We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment”

**Students with Disabilities:**

Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation.