

# Syllabus for Neural Engineering BME 661 Spring 2013

Instructor: Dr. Alvarez

Class Hours: Wed and Friday from 1:00 to 2:25

Office Hours = Friday 9:30 to 10:30 or by appointment

Place: Fenster Hall room 640

Email: [tara.l.alvarez@njit.edu](mailto:tara.l.alvarez@njit.edu)

Phone: (973) 596-5272

Office Hours: by appointment. The best way to ask questions is via email where I try to answer all emails within 24 hours. You're also more than welcome to ask me in person.

Class notes and journal articles: Available on Moodle

## I. Course Syllabus:

| Week                      | Date                               | Topic   | Journal Discussion                                     |
|---------------------------|------------------------------------|---|--|
| 1                         | 1/23/2013<br>1/25/2013             | Overview of Course<br>Neuroscience Overview                       | Fields presented by<br>Dr. Alvarez                     |
| 2-3                       | 1/30/2013<br>2/1/2013<br>2/6/2013  | Neural Networks   | Gaspard & Vanderhaeghen on 2/1<br>Penny & Frost on 2/6 |
| 3-4                       | 2/8/2013<br>2/13/2013<br>2/15/2013 | Visual Circuits, Anatomy  | Espinosa & Stryker on 2/13                             |
| 5                         | 2/20/2013<br>2/22/2013             | Eye Movements and Eye Movement<br>Recording Instrumentation       | Leigh & Kennard on 2/20<br>Rose et al. on 2/22         |
| 6                         | 2/27/2013<br>3/1/2013              | Neural Prosthetics and Functional<br>Electrical Stimulation (FES) | Bastian on 2/27<br>Sheffler & Chae on 3/1              |
| 7                         | 3/6/2013<br>3/8/2013               | EEG Instrumentation and Independent<br>Component Analysis         | Onton et al. on 3/8                                    |
| 8                         | 3/13/2013                          | Review  | Lotte et. al. on 3/13                                  |
| 8                         | 3/15/2013                          | Midterm   | None   |
| 9                         | 3/17/2013<br>-3/24/2013            | Spring Break  | None   |
| 3/17 to 3/24 Spring Break |                                    |   |  |
| 10                        | 3/27/2013<br>No Class              | Overview Imaging<br>MRI   | Seitz on 4/3   |
| 11                        | 4/3/2013<br>4/5/2013               |   |  |
| 12                        | 4/10/2013<br>4/12/2013             | Functional Imaging  | Kim & Ogawa on 4/10<br>Rubinov & Sporns on 4/12        |
| 13                        | 4/17/2013<br>4/19/2013             | Diffusion Tensor Imaging  | Greicus et al. on 4/17<br>Basser & Jones on 4/19       |
| 14                        | 4/24/2013<br>4/26/2013             | Transcranial Magnetic Stimulation                                 | Kobayashi & Pascual-Leone on<br>4/26                   |
| 15                        | 5/1/2013                           | Plasticity and Brain Computer                                     | Yonelinas et al. on 5/1                                |

|                                   |          |            |  |
|-----------------------------------|----------|------------|--|
|                                   | 5/3/2013 | Interfaces | Poldrack on 5/3                              |
| 16                                | 5/7/2013 | Review     | Birbaumer et al. on 5/7<br>Weil & Rees extra |
| <b>Final exam to be announced</b> |          |            |  |
|                                   |          |            |  |

## II. Grading:

|                            |            |
|----------------------------|------------|
| Midterm Exam:              | 25%        |
| Final Exam:                | 25%        |
| Journal Presentation:      | 20%        |
| Student Proposal Project : | 20%        |
| Journal Summaries:         | <u>10%</u> |
| Total:                     | 100%       |

## III. Exams:

All exams will be cover notes. You **MUST** bring a calculator. You will **NOT** be allowed to borrow someone else's and Dr. Alvarez will not bring extra. The exam will cover all PowerPoint presentations discussed in class and the journal papers (emphasis on the information presented in the abstract) discussed in class but not the additional information supplied by the discussion leader during the journal discussions.

## IV. Final Exam:

## V. Journal Presentation:

The last half hour of the designated classes will be spent reviewing a selected journal paper. There are journals to be reviewed by students and 1 by Dr. Alvarez. Each journal paper will have a designated discussion leader who will review the paper using PowerPoint. The discussion leader(s) must present the work as if he or she were the investigative author. The discussion should begin by describing the information presented in the paper. Reviewing just the paper will earn approximately a 'B.' Additional credit will be given if the discussion leader finds additional supporting information as well as a refuting information if it exists. Then the class will discuss the implications of the paper as a group. Your classmates and Dr. Alvarez will grade the presentation for your journal presentation grade.

## VI. Journal Summaries:

Every student must hand in a **one page** summary of the journal paper highlighting the key points of the article **INCLUDING** the discussion leader. The summaries are graded out of 10 points. Additional information from other references is encouraged.

## VII. Student Projects:

Your project grade is composed of 2 parts totaling 100 points and totaling 20% of your grade. This project is done individually.

- A. Proposal (2 pages) Due 3/6/2013 for a total of 30 points**
- B. Paper (10 pages) Due 5/3/2013 for a total of 70 points**

**A. Project Proposals:**

Write a **two page** proposal describing what you will be doing, and which type of project (research proposal or comparison of 2 theories – see below). Describe some of literature review leading up to and why you picked the topic.

Students will work individually and have a choice of two projects. You only choose 1 type of project

**B. Project Papers Due.** You will submit a 10 page paper excluding references that is singled spaced and in a font that I can read.

*Project I: Write a Research Proposal*

Pick a topic in neurology that you would like to study. Write a paper (ten page maximum eight page minimum paper, excluding references) discussing:

1. What you want to study
2. Background research of problem – what other scientists in the field have found
3. The methodology of how you would study the problem
4. Hypothesize what the results might be
5. Hypothesize what the results would mean
6. Why you feel this study should be conducted

For example, you may want to study the plasticity effects of different forms of physical therapy for stroke rehabilitation. You may want to study whether many repetitions of the same movement are better than fewer repetitions of many movements. By using functional MRI, you could determine which areas of the motor cortex are remapping and compare it to standard physical therapy functional tests such as the Barthel Index.

*Project II: Compare two or more theories in neurology describing the same phenomenon.*

Write a paper (ten page maximum eight page minimum paper, excluding references) discussing:

1. What is the phenomenon
2. What are the two or more theories that exist to describe why the phenomenon occurs
3. Which theory do you feel is more accurate and why
4. Design an experiment to test which hypothesis is correct

For example, presbyopia occurs around age 40 and results in the need for reading glasses – people become hyperopic. Some scientists believe this is due to loss of elasticity of the lens while others believe it is due to the loss of elasticity of the ciliary muscles. The experiment one could design is using MRI to study whether the lens or the ciliary muscles or both are affected when focusing near and far in two groups of people, those who are not presbyopic and those who are.