Neural Engineering

BME 4931
Class Periods: Tue 11:45-1:40, Thurs 11:45-12:35
Location: TBA
Academic Term: Spring 2017

Instructor:
Kevin Otto Ph.D.
NEB363
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Office Hours: TBD

Teaching Assistants:
Please contact through the Canvas website
- TBD

Course Description
Applying engineering to neuroscience including such diverse areas as neural tissue engineering, models of neural function, and neural interface technology. Focuses mainly in the context of neural interfaces and prosthetics, from basic neural physiology and models of neural mechanisms to advanced neural interfaces currently in development or produced commercially.

Course Pre-Requisites / Co-Requisites
BME3508: Biosignals and Systems or equivalent Signals and Systems class.

Course Objectives
- Understand the basic principles of brain anatomy, chemistry and function
- Learn about the principles of neurophysiologic recording and imaging technologies
- Learn about the applications of neural engineering in sensory, motor, neurological and mental disorders
- Understand the current challenges in neural engineering and the directions in which the area is headed

Materials and Supply Fees
Students will be responsible for a poster printing fee.

Professional Component (ABET):
State the contribution of the course to meeting the professional components of the ABET-accredited degree. Applicable only to ABET course within the degree program.

Relation to Program Outcomes (ABET):

Outcome	Coverage*
a. Apply knowledge	High
b1. Conduct experiments	
b2. Statistical design of experiments	
c. Design	
d. Function on teams	
e. Solve problems	High
f. Professional and ethical responsibility	
g. Communicate	High
h1. Economic impact	
h2. Global, societal, and environmental impact	
i. Lifelong learning	
j. Contemporary issues	
k. Techniques, skills, and tools for degree program	High

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not part of the course.

Required Textbooks and Software
No textbooks are required. Slides will be posted on the class website. Students are responsible of material presented on black board. MATLAB software will be used for some assignments and all projects.

Recommended Materials
- Title: Neural Engineering
  Editor: Bin He
  Publication date and edition: 2013, Second Edition
  ISBN number: 978-1-4614-5226-3
- Title: Neuroengineering
  Editors: DiLorenzo & Bronzino
  Publication date and edition: 2008, First Edition
  ISBN number: 978-0-8493-8174-4
- Title: Principles of Neural Science
  Authors: Kandel, Schwartz, Jessell, Siegelbaum, Hudspeth
  Publication date and edition: 2013, Fifth Edition
  ISBN number: 978-0-07-139011-8

Course Schedule
Week 1:   Basic principles of brain anatomy
Week 2:   Neurons and neural signaling: Hodgkin-Huxley models
Week 3:   Recording and stimulating electrodes
Week 4:   Invasive Recordings from the Brain & Spike sorting / Project I
Week 5:   The Motor System
Week 6:   The Motor System Engineering Application: Brain-Machine Interfaces / Project II
Week 7:   The Visual System
Week 8:   The Visual System Engineering Application: Retinal Implants
Week 9:   Non-Invasive Recordings from the Brain: Electroencephalogram (EEG)
Week 10:   Visual EEG Brain-Machine Interfaces / Project III
Week 11:   The Auditory System
Week 12:   The Auditory System Engineering Application: Cochlear Implants
Week 13:   Sensorimotor EEG Brain-Machine Interfaces / Project IV
Week 14:   Functional Electrical Stimulation, Non-invasive Neuromodulation
Week 15:   Basal Ganglia, Movement Disorders, Invasive Neuromodulation
Week 16:   Neural Engineering Poster Day

Attendance Policy, Class Expectations, and Make-Up Policy
Attendance is mandatory but not monitored. Class notes will not be provided to absent students, unless they have excused absences. Excused absences are consistent with university policies in the undergraduate catalog (https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx) and require appropriate documentation. Computers, tablets, and cell phones have to be put away during class.
10 points will be taken off from an assignment grade for every day the submission is late.

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homework Sets (8)	100	22%
Project I	100	17%
Project II	100	17%
Project III	100	17%
Project IV	100	17%
Poster Day Presentation	100	10%

Poster presentation: 10% -- Students will present the results of one of the projects of their own choice on April 18th during regular class period+ 1hr. The poster day will be publicly announced and be held in the BMS atrium.

Grading Policy
Grading Scale: All component grades will be on an A(4), B(3), C(2), D(1), F(0) basis (with + (0.33) and – (-0.33) modifiers. These will be assigned on a curve based on the raw numerical score (homework, projects, and poster presentation) for each section individually. Course average will be computed as an average of the numerical scores corresponding to the letter grades for each section individually. For information on current UF grading policies for assigning grade points, please visit: https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx.

A C- will not be a qualifying grade for critical tracking courses. In order to graduate, students must have an overall GPA and an upper-division GPA of 2.0 or better (C or better). Note: a C- average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement. More information on UF grading policy may be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx.

Students Requiring Accommodations
Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, https://www.dso.ufl.edu/drc) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation
Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at https://evaluations.ufl.edu/evals. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at https://evaluations.ufl.edu/results/.

University Honesty Policy
UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. 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." The Honor Code (https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Software Use
All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy
There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html

Campus Resources:

Health and Wellness

U Matter, We Care:

If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.

Counseling and Wellness Center: http://www.counseling.ufl.edu/cwc, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

Academic Resources

E-learning technical suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. https://www.crc.ufl.edu/.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus*:* https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

On-Line Students Complaints*:* http://www.distance.ufl.edu/student-complaint-process.