Cover Sheet: Request 15569

EEE 4XXX – Neural Signals, Systems and Technology

Info

Process	Course|New|Ugrad/Pro
Status	Pending at PV - University Curriculum Committee (UCC)
Submitter	Shannon Chillingworth schill@ece.ufl.edu
Created	12/9/2020 3:38:33 PM
Updated	3/18/2021 3:44:57 PM
Description of request	New Course

Actions

Step	Status	Group	User	Comment	Updated
Department	Approved	ENG - Electrical and Computer Engineering 19050000	Robert Fox		12/9/2020
EEE5283_Neural_Sig_Sys_Tech_Oweiss_Fall_2020.pdf					12/9/2020
College	Recycled	ENG - College of Engineering	Heidi Dublin	Tabled by department. Send back to college level when ready.	1/22/2021
No document changes					
Department	Approved	ENG - Electrical and Computer Engineering 19050000	Robert Fox	The syllabus has been edited to address suggested changes.	2/10/2021
No document changes					
College	Conditionall Approved	ENG - College of Engineering	Heidi Dublin	Conditionally Approved by Curriculum committee-- update grading policy and attendance policy links, update evaluation links, needs diversity and inclusion statement. Please adjust and send back by 3/12/2020 so that it can be reviewed by Faculty Council on 3/18.	3/5/2021
No document changes					
Department	Approved	ENG - Electrical and Computer Engineering 19050000	Robert Fox	Syllabus updated per committee suggestions	3/8/2021
EEE4XXX_Neural_Sig_Sys_Tech_UCC1.docx					3/8/2021
College	Approved	ENG - College of Engineering	Heidi Dublin	Approved by HWCOE Curriculum Committee and Faculty Council.	3/18/2021
No document changes					
University Curriculum Committee	Pending	PV - University Curriculum Committee (UCC)			3/18/2021
No document changes					
Statewide Course Numbering System					
No document changes					

Step	Status	Group	User	Comment	Updated
Office of the Registrar					
No document changes					
Student Academic Support System					
No document changes					
Catalog					
No document changes					
College Notified					
No document changes					

Course|New for request 15569

Info

Request: EEE 4XXX – Neural Signals, Systems and Technology
Description of request: New Course
Submitter: Shannon Chillingworth schill@ece.ufl.edu
Created: 12/9/2020 2:25:36 PM
Form version: 1

Responses

Recommended Prefix
Enter the three letter code indicating placement of course within the discipline (e.g., POS, ATR, ENC). Note that for new course proposals, the State Common Numbering System (SCNS) may assign a different prefix.

Response:
EEE

Course Level
Select the one digit code preceding the course number that indicates the course level at which the course is taught (e.g., 1=freshman, 2=sophomore, etc.).

Response:
4

Course Number
Enter the three digit code indicating the specific content of the course based on the SCNS taxonomy and course equivalency profiles. For new course requests, this may be XXX until SCNS assigns an appropriate number.

Response:
XXX

Category of Instruction
Indicate whether the course is introductory, intermediate or advanced. Introductory courses are those that require no prerequisites and are general in nature. Intermediate courses require some prior preparation in a related area. Advanced courses require specific competencies or knowledge relevant to the topic prior to enrollment.

Response:
Advanced

• 1000 level = Introductory undergraduate
• 2000 level = Introductory undergraduate
• 3000 level = Intermediate undergraduate
• 4000 level = Advanced undergraduate
• 5000 level = Introductory graduate
• 6000 level = Intermediate graduate
• 7000 level = Advanced graduate
• 4000/5000= Joint undergraduate/graduate
• 4000/6000= Joint undergraduate/graduate

**Joint undergraduate/graduate courses must be approved by the UCC and the Graduate Council)*

Lab Code
Enter the lab code to indicate whether the course is lecture only (None), lab only (L), or a combined lecture and lab (C).

Response:
None

Course Title
*Enter the title of the course as it should appear in the Academic Catalog. There is a 100 character limit for course titles. *

Response:
Neural Signals, Systems and Technology

Transcript Title
Enter the title that will appear in the transcript and the schedule of courses. Note that this must be limited to 30 characters (including spaces and punctuation).

Response:
Neural Sig Sys & Tech

Degree Type
Select the type of degree program for which this course is intended.

Response:
Baccalaureate

Delivery Method(s)
Indicate all platforms through which the course is currently planned to be delivered.

Response:
On-Campus

Co-Listing
Will this course be jointly taught to undergraduate, graduate, and/or professional students?

Response:
Yes

Co-Listing Explanation
Please detail how coursework differs for undergraduate, graduate, and/or professional students. Additionally, please upload a copy of both the undergraduate and graduate syllabus to the request in .pdf format. For more information please see the Co-Listed Graduate Undergraduate Courses Policy.

Response:
This course is co-listed with the graduate class. The homework portion of the graduate section will involve additional work and more advanced concepts with respect to the undergraduate section.

The exams will also involve additional questions for the graduate section with respect to the undergraduate section. Grading for the homework and projects are different from the undergraduate course. The graduate and undergraduate sections will be graded separately, for which the graduate section has additional problems and different weights for all problems. The final project shall be on a topic chosen from among the topics learned throughout the course, and the final report should consist of the following parts (i) Motivation (ii) Background, (iii) Technical Approach (iv) Results, (v) Discussions, and (vi) conclusions. It will be graded according to the following percentages: 30% for parts (i) and (ii), 45% for parts (iii) and (iv), 25% for parts (v) and (vi). Parts (i), (ii) and (v) shall discuss relations and comparisons between various related approaches which need to be comprehensive, and parts (ii) and (iv) can focus specifically on one particular approach.

Effective Term
Select the requested term that the course will first be offered. Selecting "Earliest" will allow the course to be active in the earliest term after SCNS approval. If a specific term and year are selected, this should reflect the department's best projection. Courses cannot be implemented retroactively, and therefore the actual effective term cannot be prior to SCNS approval, which must be obtained prior to the first day of classes for the effective term. SCNS approval typically requires 2 to 6 weeks after approval of the course at UF.

Response:
Earliest Available

Effective Year
Select the requested year that the course will first be offered. See preceding item for further information.

Response:
Earliest Available

Rotating Topic?
Select "Yes" if the course can have rotating (varying) topics. These course titles can vary by topic in the Schedule of Courses.

Response:
No

Repeatable Credit?
Select "Yes" if the course may be repeated for credit. If the course will also have rotating topics, be sure to indicate this in the question above.

Response:
No

Amount of Credit
Select the number of credits awarded to the student upon successful completion, or select "Variable" if the course will be offered with variable credit and then indicate the minimum and maximum credits per section. Note that credit hours are regulated by Rule 6A-10.033, FAC. If you select "Variable" for the amount of credit, additional fields will appear in which to indicate the minimum and maximum number of total credits.

Response:
3

S/U Only?
Select "Yes" if all students should be graded as S/U in the course. Note that each course must be entered into the UF curriculum inventory as either letter-graded or S/U. A course may not have both options. However, letter-graded courses allow students to take the course S/U with instructor permission.

Response:
No

Contact Type
Select the best option to describe course contact type. This selection determines whether base hours or headcount hours will be used to determine the total contact hours per credit hour. Note that the headcount hour options are for courses that involve contact between the student and the professor on an individual basis.

Response:
Regularly Scheduled

• Regularly Scheduled [base hr]
• Thesis/Dissertation Supervision [1.0 headcount hr]
• Directed Individual Studies [0.5 headcount hr]
• Supervision of Student Interns [0.8 headcount hr]
• Supervision of Teaching/Research [0.5 headcount hr]
• Supervision of Cooperative Education [0.8 headcount hr]

Contact the Office of Institutional Planning and Research (352-392-0456) with questions regarding contact type.

Weekly Contact Hours
Indicate the number of hours instructors will have contact with students each week on average throughout the duration of the course.

Response:
3

Course Description
Provide a brief narrative description of the course content. This description will be published in the Academic Catalog and is limited to 500 characters or less. See course description guidelines.

Response:
Biophysical principles of neural signaling, characterization of neural circuits and systems, technology design principles for interfacing with biological neural systems, overview of clinical and consumer applications for neurotechnology and artificial intelligence.

Prerequisites
Indicate all requirements that must be satisfied prior to enrollment in the course. Prerequisites will be automatically checked for each student attempting to register for the course. The prerequisite will be published in the Academic Catalog and must be formulated so that it can be enforced in the registration system. Please note that upper division courses (i.e., intermediate or advanced level of instruction) must have proper prerequisites to target the appropriate audience for the course.

Courses level 3000 and above must have a prerequisite.
Please verify that any prerequisite courses listed are active courses.

Response:
EEL 3XXX- Data Science for ECE (C)

Currently being reviewed by the UCC (https://secure.aa.ufl.edu/Approval/reports/14731

Completing Prerequisites on UCC forms:

• Use "&" and "or" to conjoin multiple requirements; do not used commas, semicolons, etc.
• Use parentheses to specify groupings in multiple requirements.
• Specifying a course prerequisite (without specifying a grade) assumes the required passing grade is D-. In order to specify a different grade, include the grade in parentheses immediately after the course number. For example, "MAC 2311(B)" indicates that students are required to obtain a grade of B in Calculus I. MAC2311 by itself would only require a grade of D-.
• Specify all majors or minors included (if all majors in a college are acceptable the college code is sufficient).
• "Permission of department" is always an option so it should not be included in any prerequisite or co-requisite.
• If the course prerequisite should list a specific major and/or minor, please provide the plan code for that major/minor (e.g., undergraduate Chemistry major = CHY_BS, undergraduate Disabilities in Society minor = DIS_UMN)

Example: A grade of C in HSC 3502, passing grades in HSC 3057 or HSC 4558, and undergraduate PBH student should be written as follows: HSC 3502(C) & (HSC 3057 or HSC 4558) & UGPBH
* *

Co-requisites
Indicate all requirements that must be taken concurrently with the course. Co-requisites are not checked by the registration system. If there are none please enter N/A.

Response:
N/A

Rationale and Placement in Curriculum
Explain the rationale for offering the course and its place in the curriculum.

Response:
This course provides depth for students interested in bioelectrical systems.

Course Objectives
Describe the core knowledge and skills that student should derive from the course. The objectives should be both observable and measurable.

Response:
The student will be able to describe the techniques for characterization of neural circuits and systems, and explain the principles of neurotechnology for interfacing with biological neural systems that could be useful for foundational artificial intelligence and machine learning applications.

Course Textbook(s) and/or Other Assigned Reading
*Enter the title, author(s) and publication date of textbooks and/or readings that will be assigned. Please provide specific examples to evaluate the course and identify required textbooks. *

Response:

a. Recommended Textbooks

- Title: Statistical Signal Processing for Neuroscience & Neurotechnology (SSPNT)

Editor: Karim Oweiss
Publication date and edition: 1st edition, 2010, Academic Press. ISBN number: 9780123750273

- Title: Principles of Neural Science (PNS)

Author: Kandel, Schwartz, Jessel, Siegelbaum, and Hudspeth
Publication date and edition: 5th edition, 2013, McGraw Hill. ISBN number: 9780071390118

- Title: Pattern Recognition and Machine Learning (PRML)

Author: Christopher Bishop
Publication date and edition: 2013, ISBN number: 978-0387310732

- Title: Theoretical Neuroscience (TNS)

Author: Dayan Peter and Abbott, L.
Publication date: 2001. ISBN: 9780262318723

- Title: Neural Engineering (NE)

Editor: Bin He
Publication date: 2nd ed., 2013 Edition. ISBN: 978-1461452263

Weekly Schedule of Topics

Provide a projected weekly schedule of topics. This should have sufficient detail to evaluate how the course would meet current curricular needs and the extent to which it overlaps with existing courses at UF.

Response:
Week 1: Nerve cells, ion channels, synapses, neurotransmitters & receptors/PNS Ch 4-5
Week 2: Passive and Active Properties of Nerve Cells/PNS ch. 6-7/HW 1 due
Week 3: Neural Signal Processing: Detection, Estimation and Classification of neural signals/SSPNT ch. 2; SSPNT ch.3 (or TNS ch 4)/HW 2 due
Week 4: Neural Encoding: principles of linear and nonlinear regression/PRML ch 3 or TNS ch. 1-2/HW 3 due
Week 5: Neural Decoding: principles of machine learning/PRML ch. 3/mini project 1 or essay 1
Week 6: Neural Decoding: Bayesian Inference and Artificial Neural Networks/PRML ch 4, 5
Week 7: Neural systems: Brain machine interfacing/PNS Part VI/ Quiz 1
Part II. Fundamentals of Neural Interface Engineering
Week 8: Neural Sensing: recording of neural activity/in Class material/HW 4 due
--- Spring Break ---
Week 9: Neural Sensing: Imaging of neural activity/in Class material/ mini project 2 or essay 2
Week 10: Neural Control: Basics of Control Theory/in Class material
Week 11: Neural Control: Closed-loop modulation of neural signals/in Class material/Quiz 2
Part III. Applications: Neural Interfaces and Artificial Intelligence
Week 12: Neural interface system design considerations/in Class material/NE select chapters
Week 13: Clinical applications: open and closed-loop neuromodulation for neurological disorders/ project previews
Week 14: Consumer applications: Artificial Intelligence and Biologically Inspired Machine Learning /in Class material/
Week 15: Final project presentation
Week 16: Final exam week: Final project report due

Grading Scheme

List the types of assessments, assignments and other activities that will be used to determine the course grade, and the percentage contribution from each. This list should have sufficient detail to evaluate the course rigor and grade integrity. Include details about the grading rubric and percentage breakdowns for determining grades. If

participation and/or attendance are part of the students grade, please provide a rubric or details regarding how those items will be assessed.

Response:

Assignment	Percentage of Final Grade
In class activities/participation	5%
Homework (4)	20%
Quizzes (2)	15%
Mini projects/Essays (2)	25%
Final Project/Term Paper	35%
Total	100%

Instructor(s)
Enter the name of the planned instructor or instructors, or "to be determined" if instructors are not yet identified.

Response:
Dr. Karim Oweiss

Attendance & Make-up
Please confirm that you have read and understand the University of Florida Attendance policy.
A required statement statement related to class attendance, make-up exams and other work will be included in the syllabus and adhered to in the course. Courses may not have any policies which conflict with the University of Florida policy. The following statement may be used directly in the syllabus.

• Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at:
https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

Response:
Yes

Accomodations
Please confirm that you have read and understand the University of Florida Accommodations policy.
A statement related to accommodations for students with disabilities will be included in the syllabus and adhered to in the course. The following statement may be used directly in the syllabus:

• Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, 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.

Response:
Yes

UF Grading Policies for assigning Grade Points
Please confirm that you have read and understand the University of Florida Grading policies.
Information on current UF grading policies for assigning grade points is require to be included in the course syllabus. The following link may be used directly in the syllabus:

• *https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx*

Response:
Yes

Course Evaluation Policy

Course Evaluation Policy
Please confirm that you have read and understand the University of Florida Course Evaluation Policy.
A statement related to course evaluations will be included in the syllabus. The following statement may be used directly in the syllabus:

• *Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/public-results/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.*

* *

Response:
Yes

Neural Signals, Systems and Technology

EEE 4XXX Section XXXX
Class Periods: Tu 3rd period, Th 3rd and 4th
Location: TBD
Academic Term: TBD

Instructor:
Prof. Karim Oweiss
Email Address: koweiss@ufl.edu
Office Phone Number: 352-294-1898
Office Hours: Tuesdays and Thursdays 2-3 pm

Teaching Assistant: TBD

Course Description
(3 credits) Biophysical principles of neural signaling, characterization of biological neural circuits and systems, principles of biological intelligence in neural systems, overview of applications of neurotechnology and artificial intelligence.

Course Pre-Requisites / Co-Requisites
EEL 3XXX- Data Science for ECE

Course Objectives
The student will be able to describe the techniques for characterization of neural circuits and systems, and explain the principles of biological intelligence that could be useful for foundational artificial intelligence and machine learning applications.

Materials and Supply Fees
N/A

Required Textbooks and Software

a. Recommended Textbooks

- Title: Statistical Signal Processing for Neuroscience & Neurotechnology (SSPNT)
  Editor: Karim Oweiss
  Publication date and edition: 1st edition, 2010, Academic Press. ISBN number: 9780123750273

- Title: Principles of Neural Science (PNS)
  Author: Kandel, Schwartz, Jessel, Siegelbaum, and Hudspeth
  Publication date and edition: 5th edition, 2013, McGraw Hill. ISBN number: 9780071390118

- Title: Pattern Recognition and Machine Learning (PRML)
  Author: Christopher Bishop
  Publication date and edition: 2013, ISBN number: 978-0387310732

- Title: Artificial Intelligence: A Modern Approach (AI)
  Author: Russel and Norvig
  Publication date: 4th Edition, 2021, ISBN number: 978-0-13-461099-3

- Title: Theoretical Neuroscience (TNS)
  Author: Dayan Peter and Abbott, L.
  Publication date: 2001. ISBN: 9780262318723

b. Software

1. **Python or Matlab**

Course Schedule

Part I. Fundamentals of Neural Signaling and Interfacing

Week 1: Nerve cells, ion channels, synapses, neurotransmitters & receptors/PNS Ch 4-5
Week 2: Passive and Active Properties of Nerve Cells/PNS ch. 6-7/HW 1 due
Week 3: *Neural Interfaces*: Measuring and Controlling Large Scale Neural Activity/in Class material/HW 2 due
Week 4: *Neural Signal Processing*: Detection and Classification of Neural Signals/SSPNT ch. 2-3/HW 3 due

Part II. Fundamentals of Neural Coding, Data Analysis and Pattern Recognition

Week 5: Principles of Linear and Nonlinear Regression/PRML ch 3 or TNS ch. 1-2/ Quiz 1
Week 6: Principles of Machine Learning/AI chs 19-20 or PRML ch. 3/Mini Project
Week 7: Bayesian Inference/AI chs 12-14 or PRML ch 4, 5
--- Spring Break ---
Week 8: *Neural Computations:* Sensory coding/PNS ch 21/Final Project pre-proposal
Week 9: *Neural Computations:* Cognitive and Motor coding/PNS ch 33/Quiz 2

Part III. Biological and Artificial Intelligence in Consumer and Clinical Applications

Week 10: *Neural Decoding*: Brain Machine Interfacing/SSPNT ch 6/Final Project Proposal
Week 11: *Consumer applications*: Biologically Inspired Supervised and Unsupervised Learning/in Class material/
Week 12: *Consumer applications*: Biologically Inspired Neuroevolutionary Computation/in Class material/
Week 13: *Clinical applications*: Open and Closed-loop Modulation of Neural Signals/in Class material/
Week 14: Project previews
Week 15: Final exam week: Final project presentation and report due

Evaluation of Grades

Assignment	**Percentage of Final Grade**
In class activities/participation	5%
Homework (3)	21%
Quizzes (2)	16%
Mini project (1)	23%
Final Project/Term Paper	35%
Total	**100%**

Grading rubric

This course is co-listed with the graduate class. The homework portion of the graduate section will involve additional work and more advanced concepts than the undergraduate section. The exams will also involve additional questions for the graduate section compared to the undergraduate section. Grading for the homework and projects are different from the undergraduate course. The graduate and undergraduate sections will be graded separately, for which the graduate section has additional problems and different weights for all problems. The final project shall be on a topic chosen from among the topics learned throughout the course, and the final report should consist of the following parts (i) Motivation (ii) Background, (iii) Technical Approach (iv) Results, (v) Discussions, and (vi) conclusions. It will be graded according to the following percentages: 30% for parts (i) and (ii), 45% for parts (iii) and (iv), 25% for parts (v) and (vi). Parts (i), (ii) and (v) shall discuss relations and comparisons between various related approaches which need to be comprehensive, and parts (ii) and (iv) can focus specifically on one particular approach.

Guidelines and Format

1) Mini-projects, essay and homework guidelines

There will be homework assignments testing your analytical skills. The mini-project will test your analytical and basic programing skills. Data for the mini-project will be provided by the instructor or simulated by the student. Quizzes will test your knowledge of the reading assignments.

2) Final Project Guidelines

a) The Pre-proposal:

Write a brief description of the research topic that you plan to pursue for your project/term paper, as well as the specific problems or questions you plan to address in your proposal. You will be provided with guidelines and resources on how to gain access to data to be used for your project.

Limit: 2 pages, 12-pt font size, 1.5-line spacing (no references), font type: Arial, one-inch margins.

b) The Proposal:

Based on the feedback I give you on your pre-proposal, write a proposal that should attract "funding" (aka a good grade) from your "sponsor" (instructor). Your proposal should include:

a) Background and Significance
b) Preliminary studies (if any) or relevant work
c) Research Design and Methods
d) Timeline

You should introduce the area of investigation, explain the "big picture" or significance of the specific problem that you will tackle, provide a list of the particular questions you intend to address in your experiments/simulation, and the methods you will use to conduct these experiments/simulation. It is very important to include all the details about how the data you will be working with has been/will be collected. **Limit: 4 pages** (not including references), Single spacing, one-inch margins, 12-pt font size Arial font.

c) The Final report:

Based on the actual implementation of the proposal, write a concise, yet detailed summary of all your experimental findings in the form of a final report. A key element of this report is your discussion section and how it relates to topics learned in class and challenges specific to the problem you addressed in your project. **Limit: 10 pages** (not including references or figures), Single spacing, one-inch margins, 12-pt Arial font.

Task	Topic	Grade %	Date
1	Pre-proposal (written)	5%	February 28th, 2020
2	Proposal (written)	10%	March 15th, 2020
3	Final Project Report (Written)	15%	April 25th, 2020
4	Final Presentation (Oral)	5%	April 30th, 2020

Grading Policy

Percent	Grade	Grade Points
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Class Participation & Attendance Policy, Class Expectations, and Make-Up Policy

Attendance is required as a considerable portion of your grade depends on class participation and discussion. Because the class covers a multi-disciplinary topic, questions and discussions during class are strongly encouraged. I will record class participation throughout the semester that will count towards your 5% class activities grade. Participation include summarizing a key topic discussed in previous lecture(s), responding to questions on current topic, and regularly participating in online discussions about select topics the instructor provides on the course website.

Cell phones and other electronic devices are to be silenced. No text messaging during class or exams.

Requirements for class participation and attendance, make-up exams, assignments, and other work in this course are consistent with university policies that can be found in the online catalog at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx .

Students Requiring Accommodations
Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting https://disability.ufl.edu/students/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation
Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-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://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-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.

Commitment to a Safe and Inclusive Learning Environment
The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:
- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

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: https://registrar.ufl.edu/ferpa.html

Campus Resources:

Health and Wellness

U Matter, We Care:
Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

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 Discrimination, Harassment, Assault, or Violence
If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

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 Connections Center, https://career.ufl.edu/, 392-1601. Reitz Union. Career development assistance and counseling.

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/.

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Neural Signals, Systems and Technology
EEE 5283 Section /EEL 4930 Section 2308
Class Periods: Tu 3rd period, Th 3rd and 4th
Location: Online, https://ufl.zoom.us/j/4012952055
Academic Term: Fall 2020

Instructor:
Prof. Karim Oweiss
Email Address: koweiss@ufl.edu
Office Phone Number: 352-294-1898
Office Hours: Tuesdays and Thursdays 3-4 pm

Teaching Assistant: Md. Rakib Mowla, PhD (mmowla@ufl.edu)

Course Description
(3 credits) Biophysical principles of neural signaling, characterization of neural circuits and systems, technology design principles for interfacing with biological neural systems, overview of clinical applications and industrial opportunities for neurotechnology and artificial intelligence.

Course Pre-Requisites / Co-Requisites
Graduate standing in engineering and/or neuroscience or related fields or undergraduate senior standing with consent of instructor.

Course Objectives
The student will be able to describe the techniques for characterization of neural circuits and systems, and explain the principles of neurotechnology for interfacing with biological neural systems and developing neurally inspired algorithms for Artificial Intelligence.

Materials and Supply Fees
N/A

Required Textbooks and Software

a. Recommended Textbooks

- Title: Statistical Signal Processing for Neuroscience & Neurotechnology (SSPNT)
  Editor: Karim Oweiss
  Publication date and edition: 1st edition, 2010, Academic Press. ISBN number: 9780123750273
- Title: Principles of Neural Science (PNS)
  Author: Kandel, Schwartz, Jessel, Siegelbaum, and Hudspeth
  Publication date and edition: 5th edition, 2013, McGraw Hill. ISBN number: 9780071390118
- Title: Theoretical Neuroscience (TNS)
  Author: Dayan Peter and Abbott, L.
  Publication date: 2001. ISBN: 9780262318723
- Title: Neural Engineering (NE)
  Editor: Bin He
  Publication date: 2nd ed., 2013 Edition. ISBN: 978-1461452263

b. Software

1. **Matlab** with Simulink Student Edition

Course Schedule

Part I. Fundamentals of Neurophysiology and Neural Signaling

Week 1: Nerve cells, ion channels, synapses, neurotransmitters & receptors/PNS Ch 4-5
Week 2: Passive and Active Properties of Nerve Cells/PNS ch. 6-7/HW 1 due
Week 3: *Neural Signal Processing*: Detection, Estimation and Classification of neural signals/SSPNT ch. 2; SSPNT ch.3 (or TNS ch 4)/HW 2 due
Week 4: *Neural Encoding*: principles of linear and nonlinear regression/TNS ch. 1-2/HW 3 due
Week 5: *Neural Decoding*: principles of machine learning/TNS ch. 3/mini project
Week 6: Neural systems for sensory processing and perception/PNS Part V
Week 7: Neural systems for the control of movement/PNS Part VI/ Quiz 1

Part II. Fundamentals of Neural Systems Engineering

Week 8: *Neural Sensing*: electrode recording of neural activity/in Class material/essay
Week 9: *Neural Sensing*: Super resolution imaging of neural activity/in Class material
Week 10: *Neural Control*: Neurostimulation and neuromodulation/in Class material/Quiz 2
Week 11: *Neural Control*: activity-dependent modulation of neural signals/in Class material

Part III. Applications: Technology for interfacing with specific neural circuits and systems

Week 12: Neural interface system design considerations/in Class material/NE select chapters
Week 13: *Clinical applications*: open and closed-loop neuromodulation for sensory, (cognitive) and movement disorders/ project previews
Week 14: *Consumer applications*: Artificial Intelligence and Neurotechnology Ventures/in Class material/
Week 15: Final project presentation & Final project report due

Evaluation of Grades

Assignment	**Percentage of Final Grade**	**Skill tested**
Homework Assignments (3)	24%	Analytical skills (8% each)
Quizzes (2)	20%	Knowledge of the reading assignments (10% each)
Mini project	13%	Analytical and basic programing skills
Essay	13%	Ability to comprehensively review a given topic in your own words
Final Project/Term Paper	30%	Integrity, team work, rigor, analytical and writing skills
Total	**100%**	

Guidelines and Format

1) Mini-projects, essay and homework guidelines

Data for these mini-projects/topics for essays will be provided by the instructor or simulated by the student.

2) Final Project Guidelines

a) The Pre-proposal:

Write a brief description of the research topic that you plan to pursue for your project/term paper, as well as the specific problems or questions you plan to address in your proposal. You will be provided with guidelines and resources on how to gain access to data to be used for your project.

Limit: 2 pages, 12-pt font size, 1.5-line spacing (no references), font type: Arial, one-inch margins.

b) The Proposal:

Based on the feedback I give you on your pre-proposal, write a proposal that should attract "funding" (aka a good grade) from your "sponsor" (instructor). Your proposal should include:

a) Background and Significance
b) Preliminary studies (if any) or relevant work
c) Research Design and Methods
d) Timeline

You should introduce the area of investigation, explain the "big picture" or significance of the specific problem that you will tackle, provide a list of the particular questions you intend to address in your experiments/simulation, and the methods you will use to conduct these experiments/simulation. It is very important to include all the details about how the data you will be working with has been/will be collected.

Limit: 4 pages (not including references), Single spacing, one-inch margins, 12-pt font size Arial font.

c) The Final report:
Based on the actual implementation of the proposal, write a concise, yet detailed summary of all your experimental findings in the form of a final report. A key element of this report is your discussion section and how it relates to topics learned in class and challenges specific to the problem you addressed in your project. **Limit: 10 pages** (not including references or figures), Single spacing, one-inch margins, 12-pt Arial font.

Task	Topic	Grade %	Date
1	Pre-proposal (written)	5%	October 24th, 2020
2	Proposal (written)	10%	November 7th, 2020
3	Final Presentation (Oral)	5%	December 9th, 2020
4	Final Project Report (Written)	10%	December 12th, 2020

Grading Policy

Percent	Grade	Grade Points
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Attendance Policy, Class Expectations, and Make-Up Policy
Attendance is required as a considerable portion of your grade depends on class participation and discussion. Because the class covers a multi-disciplinary topic, questions and discussions during class are strongly encouraged. I will record attendance throughout the semester.

Cell phones and other electronic devices are to be silenced. No text messaging during class or exams.

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found in the online catalog at:
https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.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 student 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.

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.

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

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