 FLORIDA ATLANTIC UNIVERSITY	NEW COURSE PROPOSAL Undergraduate Programs		UUPC Approval <u>11-03-25</u> UFS Approval _____ SCNS Submittal _____ Confirmed _____ Banner Posted _____ Catalog _____	
	Department Biological Sciences College Charles E Schmidt College of Science (To obtain a course number, contact erudolph@fau.edu)			
Prefix BSC Number 4894	(L = Lab Course; C = Combined Lecture/Lab; add if appropriate) Lab Code	Type of Course <div style="border: 1px solid red; padding: 2px;">Lecture</div>	Course Title Brain Modeling and Simulation	
Credits (See Definition of a Credit Hour) 3	Grading (Select One Option) Regular <input checked="" type="radio"/>	Course Description (Syllabus must be attached; see Template and Guidelines) This course focuses on the biophysical modeling of neural systems, with an emphasis on voltage dynamics and ion channel behavior. Students will use Python and the Brain2 simulator to build and analyze models of single neurons and networks. Core topics include modeling neurons as RC circuits, adding ionic currents, analyzing spike-train statistics, and applying information-theoretic approaches to neural coding. The course mixes theoretical foundations with hands-on simulation work, culminating in a final project that applies these methods to a neuroscience-related research question.		
Effective Date (TERM & YEAR) Fall 2026	Sat/UnSat <input type="radio"/>			
Prerequisites, with minimum grade* PCB 3063 or BCH 3033 or permission of instructor		Corequisites None	Registration Controls (Major, College, Level) None	
*Default minimum passing grade is D-. Prereqs., Coreqs. & Reg. Controls are enforced for all sections of course				
WAC/Gordon Rule Course <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No WAC/Gordon Rule criteria must be indicated in syllabus and approval attached to proposal. See WAC Guidelines .		Intellectual Foundations Program (General Education) Requirement (Select One Option) None General Education criteria must be indicated in the syllabus and approval attached to the proposal. See Intellectual Foundations Guidelines .		
Minimum qualifications to teach course Member of the FAU graduate faculty and terminal degree in the subject area (or closely related field).				
Faculty Contact/Email/Phone Rodrigo Pena / penar@fau.edu / 6-8073		List/Attach comments from departments affected by new course		
Approved by Department Chair <u>SL Milton</u> College Curriculum Chair <u>[Signature]</u> College Dean <u>[Signature]</u> UUPC Chair <u>Korey Sorge</u> Undergraduate Studies Dean <u>Dan Meeroff</u> UFS President _____ Provost _____			Date 10-15-25 10/22/25 <u>10/22/25</u> 11-03-25 11-03-25 _____ _____	

Email this form and syllabus to mjenning@fau.edu seven business days before the UUPC meeting.



FLORIDA ATLANTIC UNIVERSITY

BSC 4894

Brain Modeling and Simulation

Date: Tuesday, Thursday 8:00 AM - 9:20 AM

3 Credit(s)

Fall 2026 - 1 Full Term

Instructor Information

Rodrigo De Oliveira Pena

Email: penar@fau.edu

Office: Zoom Meetings, computer labs in the Boca campus and in the Jupiter campus TBD.

Office Hours: Monday and Wednesday from 9 AM - 11 AM. Please note you can email me at any time with your questions, comments, and concerns, or use CANVAS. Additional times/days are available to meet through Zoom.

Phone: 561-799-8514

Course Description

This course focuses on the biophysical modeling of neural systems, with an emphasis on voltage dynamics and ion channel behavior. Students will use Python and the Brian2 simulator to build and analyze models of single neurons and networks. Core topics include modeling neurons as RC circuits, adding ionic currents, analyzing spike-train statistics, and applying information-theoretic approaches to neural coding. The course mixes theoretical foundations with hands-on simulation work, culminating in a final project that applies these methods to a neuroscience-related research question.

Course Topical Outline

Week	Topic(s)	Assignment(s)

Week 1	Introduction to the course content and tools	
Week 2	Programming bootcamp - Python basics	Assignment 1: basic coding
Week 3	Programming bootcamp - Brian2	
Week 4	Integrate-and-fire models	
Week 5	The Hodgkin-Huxley model	Assignment 2: single-neuron modeling
Week 6	Model reductions and dynamical systems	Assignment 3: dynamical systems
Week 7	Spike-train statistics	
Week 8	Project proposals	Midterm - review of proposals
Week 9	Compartmental modeling	
Week 10	Neuronal populations	
Week 11	Neuronal populations	Assignment 4: Network behavior
Week 12	Information theory for neuroscience	
Week 13	Parameter estimation	
Week 14	Project discussions	
Week 15	Project presentations	Final project

Course Topical Outline

Due	Assignment	Type	Description	Points
09/12	Basic coding			100
09/26	Single-neuron modeling			100
10/03	Dynamical systems			100
10/08	Project proposals			100
11/07	Network dynamics			100

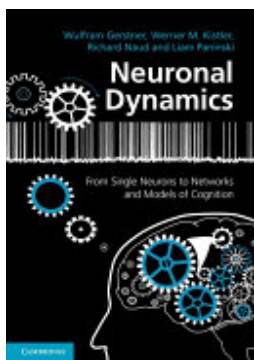
Due	Assignment	Type	Description	Points
11/26	Project presentations			100

Instructional Method

Online Live Lecture

100% of the course is delivered online, with synchronous meeting times. (The course will meet live on the specified meeting days and times.)

Required Texts/Materials



Neuronal Dynamics

ISBN: 9781107060838

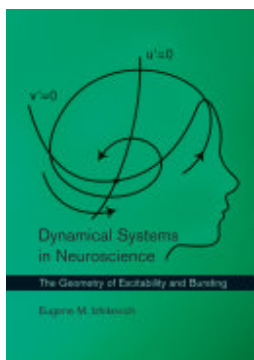
Authors: Wulfram Gerstner, Werner M. Kistler, Richard Naud, Liam Paninski

Publisher: Cambridge University Press

Publication Date: 2014-07-24

Please note that the book is freely available online.

Recommended Readings and Materials



Dynamical Systems in Neuroscience

ISBN: 9780262514200

Authors: Eugene M. Izhikevich

Publisher: MIT Press

Publication Date: 2010-01-22

Course Objectives/Student Learning Outcomes

By the end of the course, students will be able to:

- **Select and Implement Computational Models:** Choose, reproduce, and code neurons, synapses, and neural networks in Python for various neuroscience applications.
- **Understand Key Concepts in Neuroscience:** Comprehend the fundamental principles of electrophysiology and computational modeling, including commonly used statistical tools and concepts from information theory.
- **Apply Appropriate Models and Tools:** Identify and utilize suitable models and computational tools to address specific problems in neuroscience.
- **Analyze and Evaluate Model Performance:** Assess the performance of computational models by determining key parameters, applying relevant techniques to neuroscience problems, and justifying the use and limitations of these models.

Faculty Rights and Responsibilities

Florida Atlantic University respects the rights of instructors to teach and students to learn. Maintenance of these rights requires classroom conditions that do not impede their exercise. To ensure these rights, faculty members have the prerogative to:

- Establish and implement academic standards.
- Establish and enforce reasonable behavior standards in each class.
- Recommend disciplinary action for students whose behavior may be judged as disruptive under the Student Code of Conduct [University Regulation 4.007](#).

Disability Policy

In compliance with the Americans with Disabilities Act Amendments Act (ADAAA), students who require reasonable accommodations due to a disability to properly execute coursework must register with Student Accessibility Services (SAS) and follow all SAS procedures. SAS has offices across three of FAU's campuses – Boca Raton, Davie and Jupiter – however disability services are available for students on all campuses. For more information, please visit the SAS website at www.fau.edu/sas/.

Course Evaluation Method

- Homework Assignments (40%): Regular homework assignments and quizzes will be given throughout the course. The approximate number and frequency will be communicated in class.
- Proposal of Final Project (20%): Students are required to submit a proposal for their final project, which will count towards a midterm grade. The proposal format and specific requirements will be provided by the instructor.
- Final Project (40%): The final project is an individual effort for both undergrad and graduate students. Clear guidelines for the project will be provided, and it will be evaluated for the final grading.
- Assignments and Lab Days: Assignments from the computational lab day can be submitted after class. Please follow the specified submission format, which will be communicated in class.
- Project Selection: Students are expected to select a project from a list provided by the instructor. Alternatively, they may propose their own ideas for approval.
- Group Work: Undergraduates are allowed to work on the final project in groups of two. Graduate students are expected to work individually.

Code of Academic Integrity

Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty is considered a serious breach of these ethical standards, because it interferes with the university mission to provide a high quality education in which no student enjoys an unfair advantage over any other. Academic dishonesty is also destructive of the university community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. For more information, see [University Regulation 4.001](#).

Attendance Policy Statement

Students are expected to attend all their scheduled University classes and to satisfy all academic objectives as outlined by the instructor. The effect of absences upon grades is determined by the instructor, and the University reserves the right to deal at any time with individual cases of non-attendance. Students are responsible for arranging to make up work missed because of legitimate class absence, such as illness, family emergencies, military obligation, court-imposed legal obligations, or participation in University-approved activities. Examples of University-approved reasons for absences include participating on an athletic or scholastic team, musical and theatrical performances, and debate activities. It is the student's responsibility to give the instructor notice prior to any anticipated absences and within a reasonable amount of time after an unanticipated absence,

ordinarily by the next scheduled class meeting. Instructors must allow each student who is absent for a University-approved reason the opportunity to make up work missed without any reduction in the student's final course grade as a direct result of such absence.

Religious Accommodation Policy Statement

In accordance with the rules of the Florida Board of Education and Florida law, students have the right to reasonable accommodations from the University in order to observe religious practices and beliefs regarding admissions, registration, class attendance, and the scheduling of examinations and work assignments. University Regulation 2.007, Religious Observances, sets forth this policy for FAU and may be accessed on the FAU website at www.fau.edu/regulations.

Any student who feels aggrieved regarding religious accommodations may present a grievance to the executive director of The Office of Civil Rights and Title IX. Any such grievances will follow Florida Atlantic University's established grievance procedure regarding alleged discrimination.

Time Commitment Per Credit Hour

For traditionally delivered courses, not less than one (1) hour of classroom or direct faculty instruction each week for fifteen (15) weeks per Fall or Spring semester, and a minimum of two (2) hours of out-of-class student work for each credit hour. Equivalent time and effort are required for Summer Semesters, which usually have a shortened timeframe. Fully Online courses, hybrid, shortened, intensive format courses, and other non-traditional modes of delivery will demonstrate equivalent time and effort.

Course Grading Scale

Letter Grade	Letter Grade
A	94 - 100%
A-	90 - 93%
B+	87 - 89%
B	83 - 86%
B-	80 - 82%
C+	77 - 79%
C	73 - 76%
C-	70 - 72%
D+	67 - 69%
D	63 - 66%
D-	60 - 62%

Letter Grade	Letter Grade
F	Below 60

Grade Appeal Process

You may request a review of the final course grade when you believe that one of the following conditions apply:

- There was a computational or recording error in the grading.
- The grading process used non-academic criteria.
- There was a gross violation of the instructor's own grading system.

[University Regulation 4.002](#) of the University Regulations contains information on the grade appeals process

Policy on Make-up Tests, Late work, and Incompletes

- Students are expected to attend all scheduled classes and arrive on time. If you miss a class you are responsible for ALL the material covered during that class, including lecture material and rules and regulations about the course (such as penalties for late assignments, etc.). If you miss an entire or a part of a class, you are still expected to submit assignments for that week.
- Assignments: The assignments are due on the dates assigned. These will be accepted up to 1 week late, but they will be penalized 10%/day. None will be accepted over 1 week late.
- Project proposal: The project is due on the date assigned. It will be accepted up to 1 week late, but penalized 10%/day. No submission will be accepted over 1 week late.
- Final project: The final project has to be presented on the assigned date. Appropriate documentation must be presented for justifiable absence from the final project delivery.

Special Course Requirements

Access to Google Colab: <https://colab.research.google.com>. Brian2 library (<https://brian2.readthedocs.io/en/stable/index.html>): Alternatively, students can develop projects on the FAU computers or their own personal computers.

Policy on the Recording of Lectures

Students enrolled in this course may record video or audio of class lectures for their own personal educational use. A class lecture is defined as a formal or methodical oral presentation as part of a university course intended to present information or teach students about a particular subject. Recording class activities other than class lectures, including but not limited to student presentations (whether individually or as part of a group), class discussion (except when incidental to and incorporated within a class lecture), labs, clinical presentations such as patient history, academic exercises involving student participation, test or examination administrations, field trips, and private conversations between students in the class or between a student and the lecturer, is prohibited. Recordings may not be used as a substitute for class participation or class attendance and may not be published or shared without the written consent of the faculty member. Failure to adhere to these requirements may constitute a violation of the University's Student Code of Conduct and/or the Code of Academic Integrity.

Artificial Intelligence Preamble

FAU recognizes the value of generative AI in facilitating learning. However, output generated by artificial intelligence (AI), such as written words, computations, code, artwork, images, music, etc., for example, is drawn from previously published materials and is not your own original work.

FAU students are not permitted to use AI for any course work unless explicitly allowed to do so by the instructor of the class for a specific assignment. [\[Policy 12.16 Artificial Intelligence\]](#)

Class policies related to AI use are decided by the individual faculty. Some faculty may permit the use of AI in some assignments but not others, and some faculty may prohibit the use of AI in their course entirely. In the case that an instructor permits the use of AI for some assignments, the assignment instructions will indicate when and how the use of AI is permitted in that specific assignment. It is the student's responsibility to comply with the instructor's expectations for each assignment in each course. When AI is authorized, the student is also responsible and accountable for the content of the work. AI may generate inaccurate, false, or exaggerated information. Users should approach any generated content with skepticism and review any information generated by AI before using generated content as-is.

If you are unclear about whether or not the use of AI is permitted, ask your instructor before starting the assignment.

Failure to comply with the requirements related to the use of AI may constitute a violation of the [Florida Atlantic Code of Academic Integrity, Regulation 4.001.](#)

Proper Citation: If the use of AI is permitted for a specific assignment, then use of the AI tool must be properly documented and cited. For more information on how to properly cite the use of AI tools, visit <https://fau.edu/ai/citation>

AI Language Specific To This Course

AI Encouraged: The use of AI to assist in work assigned in this specific course is encouraged for various purposes. The instructor hereby permits the use of AI to assist in work assigned for this course, unless the instructor expressly indicates AI is not permitted on a particular assignment. Use must be properly documented and cited per instructor guidelines (<https://fau.edu/ai/citation>).

Counseling and Psychological Services (CAPS) Center

Life as a university student can be challenging physically, mentally and emotionally. Students who find stress negatively affecting their ability to achieve academic or personal goals may wish to consider utilizing FAU's Counseling and Psychological Services (CAPS) Center. CAPS provides FAU students a range of services – individual counseling, support meetings, and psychiatric services, to name a few – offered to help improve and maintain emotional well-being. For more information, go to <http://www.fau.edu/counseling/>

Student Support Services and Online Resources

- [Center for Learning and Student Success \(CLASS\)](#)
- [Counseling and Psychological Services \(CAPS\)](#)
- [FAU Libraries](#)
- [Math Learning Center](#)
- [Office of Information Technology Helpdesk](#)
- [Center for Global Engagement](#)
- [Office of Undergraduate Research and Inquiry \(OURI\)](#)
- [Science Learning Center](#)
- [Speaking Center](#)
- [Student Accessibility Services](#)
- [Student Athlete Success Center \(SASC\)](#)
- [Testing and Certification](#)
- [Test Preparation](#)
- [University Academic Advising Services](#)
- [University Center for Excellence in Writing \(UCEW\)](#)
- [Writing Across the Curriculum \(WAC\)](#)