NEW COURSE PROPOSAL
Graduate Programs

FLORIDA ATLANTIC UNIVERSITY

Department

College
(*To obtain a course number, contact **erudolph@fau.edu***)

UGPC Approval _____

UFS Approval _____

SCNS Submittal _____

Confirmed _____

Banner _____

Catalog _____

Prefix **Number**	*(L = Lab Course; C = Combined Lecture/Lab; add if appropriate)* **Lab** **Code**	**Type of Course**	**Course Title**

Credits *(See Definition of a Credit Hour)* **Effective Date** *(TERM & YEAR)* Spring 2025	**Grading** *(Select One Option)* **Regular** **Sat/UnSat**	**Course Description** *(Syllabus must be attached; see Template and Guidelines)*

Prerequisites *Prerequisites, Corequisites and Registration Controls are enforced for all sections of course.*	**Academic Service Learning (ASL) course** Academic Service Learning statement must be indicated in syllabus and approval attached to this form.

	Corequisites	**Registration Controls** *(For example, Major, College, Level)*

Minimum qualifications needed to teach course: Member of the FAU graduate faculty and has a terminal degree in the subject area (or a closely related field).	**List textbook information in syllabus or here**

Faculty Contact/Email/Phone	**List/Attach comments from departments affected by new course**

Approved by		*Date*
Department Chair	SL Mitton	11-18-24
College Curriculum Chair		11/18/2024
College Dean		11/18/2024
UGPC Chair		
UGC Chair		
Graduate College Dean		
UFS President		
Provost		

Email this form and syllabus to UGPC@fau.edu 10 days before the UGPC meeting.

FLORIDA ATLANTIC UNIVERSITY

BSC 6885
Biological Networks
Date: Day, Time
Building: NA **Room:** NA
3 Credit(s)
Semester Year - 1 Full Term

Instructor Information

Instructor: Ashkaan Fahimipour
Email: afahimipour@fau.edu
Office: Sanson 206
Office Hours: Day and time

Course Topical Outline

Unite	Topics	Assignments	Date
What are complex systems?	Example complex biological systems, and how we understand and model them	Code companion 1	1/9
Networks describe the world	Intro. to network science, greedy algorithms for efficient transport networks, spanning trees, adjacency matrices	HW 1	1/16
	Shortest paths through a landscape, finding efficient movement routes, visualization with R and *igraph*	Code companion 2	1/23
	Small worlds in social networks, friendship paradox *or* "why your friends have more friends than you"	HW 2, Reading 1	1/30
	Degree distributions in networks, simulating the spread of changing opinions on social networks	Reading 2	2/6
Changes *on* and *of* networks	Intro. to dynamical systems, equations for population growth	HW 3	2/13
	2 and 3 dimensional continuous-time ecosystems with predators and prey and plants	Code companion 3	2/20
	Stability analysis and Jacobian matrices for food webs	Midterm project proposal	2/27
	Bifurcations, coarse-graining animal behavior into equations, eigensolutions	HW 4, Reading 3	3/12
	Equations for heat and vibrations for modeling migrating animals, classifying biological datasets, fragmenting landscapes *or* the minimal cut	HW 5	3/19
	Impact and sensitivity to ecological perturbations, Laplacian matrices for modeling migration	Reading 4	3/26
Applications to data	Data visualization	HW 6	4/2

	The curse of dimensionality, manifold learning applied to genomic data	Reading 5	4/9
Complex systems thinking	Applications of complex systems science in microbiology, ecology, evolutionary biology, epidemiology, archaeology, social sciences, and other fields	HW 7	4/16
	Applications II	Reading 6	4/23
		Final project	Finals

Instructional Method
In-Person
Traditional concept of in-person. Attendance is mandatory.

Course Description
This course explores network science and complexity theory with a strong emphasis on applications to biological systems. Graduate students will learn to construct and analyze mathematical models of interacting biological units — such as cells, individuals, and species — focusing on emergent biological phenomena like self-organization, resilience, and response to disturbance. Independent research is a core component, as students develop and extend models or methods from class to address novel questions in biology, ideally related to their thesis work. Utilizing the R programming language, students will explore biological datasets and perform computer simulations to gain insights into the structure and function of complex biological networks, equipping them for advanced research in systems biology and network-based biological analysis.

Course Objectives/Student Learning Outcomes
By the end of this course, graduate students will be adept at applying network science to model complex biological systems, perform in-depth analyses of biological datasets, and effectively communicate research findings in a professional setting. They will gain a deep theoretical understanding of complex systems, developing advanced computational and mathematical models to examine biological phenomena such as ecosystem dynamics, cellular communication, disease spread, animal movement, and gene regulation. Students will lead discussions on cutting-edge biological applications, refine code for complex data analysis, and present an original research project in a seminar format, demonstrating proficiency in biological modeling and analytical techniques.

Special Course Requirements
We will use computer software in this course to perform computer simulations. To do this, you will need to interact with computer code in the R programming language. I recommend that you use the RStudio or VSCode IDEs to do this. An IDE (Integrated Development Environment) is an app that provides a comprehensive set of tools for interacting with a programming language, including editing tools, debugging, and creating data visualizations. You can get a head start by installing these pieces of software on a laptop or desktop computer that you can access throughout the term. You need to install the R language, *before* installing RStudio.

R can be downloaded for your Operating System from this east coast mirror: https://mirrors.nics.utk.edu/cran/.

RStudio (Free Desktop Edition) can be downloaded here: https://posit.co/downloads/. If you already have programming experience, you may feel free to use your preferred language to complete assignments or your final project *e.g.*, Python, Julia, C++. You may also prefer alternate IDEs. For instance, almost all of my work is done in Julia (*my favorite!*) using VSCode (IDE).

Required Texts/Materials

No textbook is available for this course. Course materials are a mixture of peer-reviewed papers, and custom model simulation code. Below are two optional texts that may help students better understand some of the more advanced tools in this course.

Introduction to the Modeling and Analysis of Complex Systems
ISBN: 9781942341093
Authors: Hiroki Sayama
Publication Date: 2023-11-28
This text is not required, but it covers a lot of relevant topics and you may enjoy it.

Networks
ISBN: 9780192527493
Authors: Mark Newman
Publisher: Oxford University Press
Publication Date: 2018-07-04
This text is not required, but it covers a lot of relevant topics and you may enjoy it.

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

Grades are based on [i] homework problem sets (50%), [ii] a midterm project proposal (15%), and [iii] a final project (25%) delivered to the class, in addition to [iv] in-class participation points (10%).

Homework
Approximately 6 problem sets will be due in this course. Graduate students will be evaluated based on their ability to apply advanced network science concepts to solve complex, multi-step problems. Each assignment will require critical thinking, original code development, and an analysis of the biological implications of their models. Solutions should demonstrate a deep understanding of both the theoretical framework and computational techniques, and originality in exploring extensions or new uses of the methods. **Detailed write-ups explaining the rationale and methodology behind the solutions are expected.** Problem sets will contain questions with 2 tiers of difficulty. *Graduate students must complete tier 1 and tier 2 problems.* Assignments will be due 1 week after the relevant material has been covered. Students may collaborate on assignments outside of class on things like access to computers, installing software, debugging computer code, etc. But, answers to problems should be your own. Homework will be posted on the course website, and can be submitted as a PDF made with a medium of your preference. This includes hand-writing on paper, creating a PDF from a Google Doc / Microsoft Word / Apple Pages

document, or using a typesetting language like LaTeX (https://www.latex-project.org/) on a service like Overleaf (https://www.overleaf.com/) (*my favorite*). You will need access to a computer to complete assignments. Please see Prof. Fahimipour if you need help accessing a computer.

Final project
Graduate students will extend, refine, or apply the models and methods introduced in class in novel ways. Projects should demonstrate an original approach, either by integrating new datasets, developing theoretical advancements, or applying the frameworks in uncharted biological contexts. You are expected to submit a written report detailing your methodology, results, and implications for network science. A formal presentation of findings will be required, showcasing your contributions and critical analysis.

Course Grading Scale

Letter Grade	Letter Grade
A	93 - 100%
A-	90 - 92%
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%
F	Below 60

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. **Please *do not* cheat**. It is difficult to cheat in this course, anyway. I advise you to especially avoid using LLMs (*e.g.*, ChatGPT), AI language models do not do well in this course since they cannot perform advanced quantitative reasoning.

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. Absences may result in a 5% reduction per unexcused absence from participation points. Legitimate reasons must be reported beforehand.

Attendance is mandatory. But, please do *stay home* if you are sick. This class is built on mutual respect, and so I will assume absences are legitimate, including but not limited to illness, family emergencies, university obligations, *etc.* Lecture slides and course materials will be made available electronically.

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.

Grade Appeal Process

You may request a review of the final course grade when you believe that one of the following 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 appeals process

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

Late work will not be accepted unless prearranged or in the case of emergencies with documentation.

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. Recordings may not be used as a substitute for class participation or class attendance and **may not be** shared. Failure to adhere to these requirements may constitute a violation of the University's Student Code of Conduct.

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)

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 using FAU's Counseling and Psychological Services (CAPS) Center. For more information, go to www.fau.edu/counseling/ or you can **talk to me at any time**, and I will help you make arrangements.

◻ Outlook

Re: Biological Networks PhD course

From Gary Perry <perryg@fau.edu>
Date Mon 10/28/2024 11:47 AM
To Ashkaan Fahimipour <afahimipour@fau.edu>
Cc William Hahn <whahn@fau.edu>; Sarah Milton <smilton@fau.edu>

Hi Ash,

Sorry, thought I had forwarded this response to you. Anyway, as you can see, I have heard back from William Hahn and he is fine with the course proposal "Biological Networks" as you have proposed it.

You can use this email when you submit the course to GPC for approval.

Cheers
Gary

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Gary W. Perry, PhD
Professor of Neuroscience & Acting Director
Center for Complex Systems and Brain Sciences
& Department of Psychology
Charles E. Schmidt College of Science
Florida Atlantic University
777 Glades Road
Boca Raton, FL 33431
Email: perryg@fau.edu

FAU

From: William Hahn <whahn@fau.edu>
Sent: Wednesday, September 25, 2024 6:45 PM
To: Gary Perry <perryg@fau.edu>
Subject: Re: Biological Networks PhD course

Looks like a good course, I'm familiar with the textbook he is using. I think it's good to endorse it, maybe we can add it to the track we were promised from Blakely.

Talk to you soon, William

From: Gary Perry <perryg@fau.edu>
Sent: Wednesday, September 25, 2024 6:41:17 PM
To: William Hahn <whahn@fau.edu>
Subject: Fwd: Biological Networks PhD course

Hi William,

Can you take a look at this and let me know if you are OK with it?

Cheers
Gary
Sent from my iPad

Begin forwarded message:

From: Ashkaan Fahimipour <afahimipour@fau.edu>
Date: September 23, 2024 at 9:03:57 PM GMT+2
To: Gary Perry <perryg@fau.edu>
Subject: Biological Networks PhD course

Hi, Gary!

I've recently submitted my PhD-level '*Biological Networks*' course to grad college
+ the state to be approved as a new course (currently taught as a Special
Topics). They've asked for a brief letter from yourself, and Dr. Wang (math), to our
department chair (Sarah Milton) endorsing the course.

Would you be able to provide a 1-2 sentence letter to Dr. Milton for approval? I'd
appreciate this greatly. I've attached a syllabus, and am happy to chat further if
that'd be helpful.

Sincerely,

Ash
Assistant Professor
Department of Biological Sciences
Center for Complex Systems
Florida Atlantic University

Hi Sarah,

The course looks interesting. There is no objection from Math.

Best regards,
Yuan