FLORIDA ATLANTIC UNIVERSITY

NEW COURSE PROPOSAL
Undergraduate Programs

Department Mathematical Sciences

College Science

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

UUPC Approval 11/6/23
UFS Approval _____
SCNS Submittal _____
Confirmed _____
Banner Posted _____
Catalog _____

Prefix MAP **Number** 2484	*(L = Lab Course; C = Combined Lecture/Lab; add if appropriate)* **Lab Code**	**Type of Course** Lecture	**Course Title** Mathematics for Biological Sciences 2

Credits *(See Definition of a Credit Hour)*: 4

Effective Date *(TERM & YEAR)*: Fall 2024

Grading *(Select One Option)*: Regular (●) Sat/UnSat ( )

Course Description *(Syllabus must be attached; see Template and Guidelines)*

This is the second semester of the Mathematics for Biological Sciences sequence. It develops the foundational mathematical machinery necessary to study behaviors and properties of continuous and discrete dynamical systems of more than one variable including results from multivariate calculus, differential equations, and linear algebra. Mathematical concepts are grounded in real examples from, and applications to, biology, physiology, neuroscience, ecology, evolution, psychology, and/or the social sciences. Theory is complemented with basic programming to aid visualization, modeling, and simulation.

Prerequisites, with minimum grade*

MAP 2483 (C or better) or MAC 2233 (C or better) or MAC 2241 (C or better) or MAC 2311 (C or better)

Corequisites

Registration Controls *(Major, College, Level)*

Default minimum passing grade is D-.** **Prereqs., Coreqs. & Reg. Controls are enforced for all sections of course

WAC/Gordon Rule Course

☐ Yes ☑ 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

PhD in Mathematics or related fields

Faculty Contact/Email/Phone

Necibe Tuncer / ntuncer@fau.edu

List/Attach comments from departments affected by new course

Approved by	***Date***
Department Chair: [signature]	9/19/2023
College Curriculum Chair: Korey Sorge	10-9-23
College Dean: [signature]	10/25/23
UUPC Chair: Korey Sorge	11/6/23
Undergraduate Studies Dean: Dan Macroff	11/6/23
UFS President:	
Provost:	

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

MAP 2484-001
Mathematics for Biological Sciences 2

MWF XXXX – XXXX
4 credits

Fall, 2024
Prof. XXXX
Office: XXXX
Office hours: XXXX
Classroom: XXXX
Telephone: 561-297-XXXX
Email: XXXX

TA name	xxxxxx xxxxxxxxx
Office	xxxxxxxx
Office hours	MWF xx:xx – xx:xx
Telephone	561-297-xxxx
Email	xxxxxx@fau.edu

Course Description

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Instructional Method

In-Person. There is no remote option for this course.

Prerequisites/Corequisites

Mathematics for Biological Sciences 1 (MAP 2483) or MAC 2233 (Methods of Calculus) or MAC 2241 (Life Sciences Calculus I) or MAC 2311 (Analytic Geometry and Calculus I) (with a minimum grade of C).

Course Objectives/Student Learning Outcomes

Students will gain a deep conceptual understanding of mathematical topics in a traditional linear algebra and advanced calculus course through the study of a wide range of dynamic processes in various biological sciences including biology, physiology, neuroscience, and ecology. Students will understand how mathematical methods that model changes in the states of a biological system can elucidate biological phenomena. Specifically, students will be able to

- Describe a variety of behaviors exhibited by discrete and continuous dynamical systems including oscillations and chaos.
- Explain simple mechanisms and bifurcations that can give rise to these behaviors.
- Define basic properties of n-dimensional vector spaces and compute with vectors.

- Explain the meaning of matrices as linear functions.
- Compute eigenvalues and eigenvectors of matrices and describe their geometric meaning.
- Apply linear algebra theory to study discrete and continuous dynamical systems.
- Compute partial derivatives of functions of multiple variables and explain their meaning.
- Explain the geometric meaning of the Jacobian matrix.
- Understand the use of linear algebra tools to study stability of equilibria in multi-dimensional, non-linear differential equations.

Students will also learn the rudiments of a programming language to plot functions and data, simulate differential equations, and model dynamic processes.

Required Texts/Readings

Modeling Life: The Mathematics of Biological Systems, Alan Garfinkel, Jane Shevtsov, Yina Guo, Springer International Publishing AG 2017

ISBN 978-3-319-59730-0 ISBN 978-3-319-59731-7 (eBook)
DOI 10.1007/978-3-319-59731-7
Library of Congress Control Number: 2017943196

Course Evaluation Method

A final grade percentage will be determined for each student based on the grades earned on weekly homework, 2 in-class exams, and the cumulative final. Weights toward to the final grade for assignment categories are:
Homework – 30%
Exams 1 & 2 – 50%
Final Exam – 20%

Course Grading Scale

This course uses a standard grading scale to assign final letter grades. Thresholds for letter grades will not be higher than: ≥90% (A), ≥80% (B), ≥70% (C), ≥60% (D), <60% (F)

Policy on Makeup Tests, Late Work, and Incompletes

Students are responsible for arranging to make up work missed because of legitimate reasons, such as illness, family emergency, military obligation, court-imposed legal obligations or participation in University-approved activities, such as participating on an athletic or scholastic team, musical and theatrical performances and debate activities. It is the students' responsibility to give the instructor notice prior to any missed work. Any student missing an exam without an official excuse will receive a zero grade. Any excusable absence must be documented by a verifiable source, the instructor must be provided with the FAU-approved documents, and the instructor must be notified AT LEAST THREE DAYS prior to the due date. Except in extraordinary circumstances, all make-up exams must be taken within 48 hours of the due date of the missed work. In an emergency the student must inform the instructor about their missed work within 2 days of the due date of the missed work, along with university-approved documents to be allowed to make-up the missed work. The FAU-approved documents should be from a third party, who are not related to the student. All make-ups, if approved, must be completed within 48 hours of the due date. There are no make-ups for final exam. There are no

make-ups for any homework and worksheets, since all homework and worksheets for this course will be open and available to the students from the beginning of the semester.

The grade of I (incomplete) can only be given under the conditions specified in the "Incomplete Grades" section of the FAU Catalog, and supporting documentation will be required.

Classroom Etiquette Policy

Disruptive behavior is defined in the FAU Student Code of Conduct as "... activities which interfere with the educational mission within classroom." Students who disrupt the educational experiences of other students and/or the instructor's course objectives in a face-to-face or online course are subject to disciplinary action. Such behavior impedes students' ability to learn or an instructor's ability to teach. Disruptive behavior may include but is not limited to non-approved use of electronic devices (including cellular telephones); cursing or shouting at others in such a way as to be disruptive; or, other violations of an instructor's expectations for classroom conduct. For more information, please see the FAU Office of Student Conduct.

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.

Attendance Policy

Students are expected to attend all of 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.

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/

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/.

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.

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.

Chapter 4 of the University Regulations contains information on the grade appeals process.

RELIGIOUS ACCOMMODATION POLICY STATEMENT

In accordance with 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. For further information, please see Academic Policies and Regulations.

DROPS/WITHDRAWALS

You are responsible for completing the process of dropping or withdrawing from a course. Please click on the following link for more information on dropping and/or withdrawing from a course. Please consult the FAU Registrar Office for more information.

Course Topical Outline

Week 1 - Mechanisms of Oscillations (Sections 4.1-4.2).

Week 2 - Bifurcations and the Onset of Oscillations (Sections 4.3-4.4).

Week 3 - Discrete-time Dynamics and Chaos (Sections 5.1-5.2)

Week 4 - Routes to and Examples of Chaos (Sections 5.3-5.4)

Week 5 - Review and Exam 1

Week 6 - Linear Functions and Matrices (Sections 6.1-6.2)

Week 7 - Matrices and Matrix Models (Sections 6.2-6.3)

Weeks 8 & 9 - Eigenvalues & Eigenvectors (Sections 6.4-6.5)

Week 10 - Linear Differential Equations (Section 6.7)

Week 11 - Review and Exam 2

Week 12 - Multivariate Systems & Vector Fields (Sections 7.1-7.3)

Week 13 - Nonlinear Functions in n-dimensions (Section 7.4)

Weeks 14 & 15 - Linear Approximations & Stability of Equilibria (Section 7.5)