NEW COURSE PROPOSAL Graduate Programs

Department Department of Mathematics and Statistics

UFS Approval
SCNS Submittal
Confirmed
Banner

UGPC Approval _

College Science

(To obtain a course number, contact erudolph@fau.edu)			Catalog	
Prefix MAP Number 6113	(L = Lab Course; C = Combined Lecture/Lab; add if appropriate) Lab Code	Type of Course Lecture	Course Title Mathematics for A	Artificial Intelligence
Credits (See <u>Definition</u> of a Credit Hour)	Grading (Select One Option) Regular	Guidelines) This course introdu intelligence, with a contextualize Al-rel	ces key mathematical co focus on preparing educ ated mathematics in the	e attached; see <u>Template</u> and oncepts underpinning artificial ators to understand, teach, and classroom. Topics include linear
Effective Date (TERM & YEAR) SPRING 2026	Sat/UnSat	networks and mach	nine learning models. Stu	and the mathematics behind neural udents will also explore educational l. This course is not intended for
Prerequisites Enrollment in MST in Mathematics program or permission of instructor		Academic Service Learning (ASL) course Academic Service Learning statement must be indicated in syllabus and approval attached to this form.		
		Corequisites	R	egistration Controls (For cample, Major, College, Level)
Prerequisites, Corequisites and Registration Controls are enforced for all sections of course.				
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 Mathematics for Machine Learning, by Deisenroth, M. P., Faisal, A. A., & Ong, C. S. (2020). Cambridge University Press.		
Faculty Contact/Email/Phone kwinkows@fau.edu Katarzyna Winikowska-Now		List/Attach comments from departments affected by new course Department of Electrical Engineering and Computer Science Department of Curriculum & Instruction		

Approved by	Date
Department Chair The	09/10/2025
College Curriculum Chair	9/22/2025
College Dean	9/22/2025
UGPC Chair	
UGC Chair ————————————————————————————————————	
Graduate College Dean	
UFS President	
Provost	

Email this form and syllabus to $\underline{\text{UGPC@fau.edu}}\ 10$ days before the UGPC meeting.



MATHEMATICS FOR ARTIFICIAL INTELLIGENCE MAP 6113

Department of Mathematics and Statistics Spring 2026 3 Credit Hours

Instructor: Dr. Katarzyna Winkowska-Nowak

Office Location: Boca, SE43, 358
Office Hours: Zoom by Appointment

Email: kwinkows@fau.edu

COURSE DESCRIPTION

This course introduces key mathematical concepts underpinning artificial intelligence, with a focus on preparing educators to understand, teach, and contextualize AI-related mathematics in the classroom. Topics include linear algebra, probability, statistics, optimization, and the mathematics behind neural networks and machine learning models. Students will also explore educational applications and ethical considerations in AI.

COURSE PREREQUISITES

Enrollment in MST in Mathematics program or permission of instructor

COURSE OBJECTIVES

Upon successful completion of this course, students will be able to:

- Analyze and interpret the mathematical principles behind AI models.
- Solve problems involving vector spaces, transformations, and eigenvalues.
- Apply probability and statistics to model uncertainty in AI.
- Understand optimization techniques used in training algorithms.

- Interpret and explain the mathematics behind neural networks.
- Prepare classroom materials and lesson plans related to the mathematics of Al.

COURSE TOPICAL OUTLINE

Week 1: Introduction to AI and Key Mathematical Ideas

Week 2: Vectors, Matrices, and Basic Operations

Week 3: Matrix Applications and Introduction to PCA

Week 4: Functions of Several Variables and Gradients

Week 5: Introduction to Optimization and Cost Functions

Week 6: Probability Basics and Conditional Probability

Week 7: Random Variables and Expected Values

Week 8: Data, Statistics, and Trends

Week 9: Modeling with Linear and Logistic Regression

Week 10: Neural Networks: What They Are and Why They Work

Week 11: How Machines Learn: Backpropagation Made Simple

Week 12: Deep Learning and Big Models

Week 13: AI in Society: Ethics and Fairness

Week 14: Final Presentations and Course Wrap-up

COURSE DELIVERY MODE

This is a fully online course accessible only through FAU's learning management system, Canvas. You must log into Canvas with your FAU ID and Password to access the materials and assignments in this course. If you do not know your FAU ID or Password, contact OIT for help.

The course is organized into modules with due dates. Unless otherwise specified, each module begins on Monday at 12:00am, EST, and ends on Sunday at 11:59pm, EST. The course begins with the Start Here module, which will familiarize you with the organization and navigation of the course. You will open a new learning module to access the assigned reading materials, videos, presentations, and other relevant materials for each subsequent module.

TIME COMMITMENT PER CREDIT HOUR

This course has 3 credit hours. 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.

REQUIRED TEXTS & MATERIALS

In this course, you will need the following texts and/or materials:

• Deisenroth, M. P., Faisal, A. A., & Ong, C. S. (2020). Mathematics for Machine Learning. Cambridge University Press.

Other texts and/or materials:

Selected research papers and articles provided via LMS

MINIMUM TECHNOLOGY & COMPUTER REQUIREMENTS

HARDWARE & SOFTWARE REQUIREMENTS

Hardware

- Dependable computer
- Computer speakers
- Headset with microphone
- Webcam

Software

- Microsoft 365 Suite
- Reliable web browser (recommended Chrome or Firefox)
- Canvas mobile app: Download instructions for iOS device or Android device
- Adobe Reader
- Adobe Flash Player
- GeoGebra

Internet Connection

• Recommended: Broadband Internet connection with a speed of 4 Mbps or higher.

- To function properly, Canvas requires a high-speed Internet connection (cable modem, DSL, satellite broadband, T1, etc.). The minimum Internet connection speed to access Canvas is a consistent 1.5 Mbps (megabits per second) or higher.
- Check your Internet speed here.

Other Technologies

This course uses GeoGebra. Please review the following regarding the use of GeoGebra as a requirement of this course.

Terms of Service | Accessibility

COMPUTER REQUIREMENTS

Basic Computer Specifications for Canvas

- Operating system: Windows 10 or macOS Sierra (or higher).
- Specifications

Peripherals

• A backup option should be available to minimize the loss of work. This can be an external hard drive, a USB drive, cloud storage, or your folder on the FAU servers.

Software

- Once logged in to Canvas make sure your Internet browser is compatible.
- Other software may be required for specific learning modules. If so, the necessary links to download and install will be provided within the applicable module.
- GeoGebra
- Presentation Software (i.e. PowerPoint)
- Recording tool to present content

MINIMUM TECHNICAL SKILLS REQUIREMENTS

The general and course-specific technical skills you must have to succeed in the course include but are not limited to:

- Accessing Internet.
- Using GeoGebra.
- Using Canvas (including taking tests, attaching documents, etc.).
- Using email with attachments.

- Creating and submitting files in commonly used word processing program formats such as Microsoft Office Tools.
- Copying and pasting functions.
- Downloading and installing software.
- Using presentation, graphics, and other programs.
- Posting and commenting in an online discussion.
- Searching the FAU library and websites.

TECHNICAL SUPPORT

In the online environment, technical issues are always possible (e.g., lost connection, hardware or software failure). Many of these can be resolved relatively quickly, but if you wait until the last minute before due dates, the chances of these glitches affecting your success are greatly increased. Please plan appropriately. If a problem occurs, it is essential you take immediate action to document the issue so your instructor can verify and take appropriate action to resolve the problem. Most issues in Canvas can be resolved by clicking on the "Help" tab located on the menu bar.

When a problem occurs, click "Help" to:

- Report a Problem
- Live Chat with Canvas Support
- Search Canvas Guides

Additional Technical Support

- 1. Contact the eLearning Success Advisor for assistance: 561-297-3590
- 2. If you can, make a Print Screen of the monitor when the problem occurs. Save the Print Screen as a .jpg file. If you are unfamiliar with creating a Print Screen file, see Print Screen instructions.
- 3. Complete a <u>Help Desk ticket</u>. Make sure you complete the form entirely and give a full description of your problem so the Help Desk staff will have the pertinent information in order to assist you properly. This includes:
 - a. Select "Canvas (Student)" for the Ticket Type.
 - b. Input the Course ID.
 - c. In the Summary/Additional Details section, include your operating system, Internet browser, and Internet service provider (ISP).
 - d. Attach the Print Screen file, if available.
- 4. Send a message within Canvas to your instructor to notify him/her of the problem. Include all pertinent information of the incident (2b-d above).
- 5. If you do not have access to Canvas, send an email to your instructor with all pertinent information of the incident (2b-d above).

- 6. If you do not have access to a computer, call your instructor with all pertinent information of the incident. If he/she is not available, make sure you leave a detailed message.
- 7. If you do not hear back from the Help Desk or your instructor within a timely manner (48 hours), it is your responsibility to follow up with the appropriate person until you obtain a resolution.

COURSE ASSESSMENTS, ASSIGNMENTS & GRADING POLICY

GRADING CRITERIA

Introductions and Syllabus Quiz (0%)

You will post an introduction in the student introductions discussion board and take a syllabus quiz. You can take the syllabus quiz as many times as necessary to achieve 100%.

Discussion Boards (20%)

As part of the course assignments, you will be asked to post an original submission to the discussion board and reply to at least two other students' posts with a substantive response. A substantive response adds value to the discussion by bringing new ideas, research, evidence, etc. to the conversation. "I agree," "Ditto" and the like are not acceptable replies. The rules of Netiquette must be followed. Replies are not texts with your friends. Full sentences, proper spelling, source citations, etc., are expected.

Ensure that postings contain detailed responses to each question and that course and chapter contents are applied in your discussion responses. For example, consider taking a new approach in presenting chapter content, cite new examples, present external research (paraphrase, avoid unnecessary and/or lengthy quotations; do not plagiarize, cite references). For maximum points, please reference external research or examples as well as the discussion rubrics.

Project: GeoGebra Book (30%)

In this course you will be asked to participate in active learning through the development of your own GeoGebra book based on a topic chosen from a provided list. In this GeoGebra book, you will select a topic, develop a lesson plan, create a draft of your presentation, provide and receive peer feedback, and present your final presentation to the class. You have the opportunity to add video and audio to your presentation in order to convey your content. You may use the screencast, audio, and video tools provided within PowerPoint as well as a personal microphone and camera. You may also select from another video or screen recording

tool such as BigVu, Tablet, YouTube, WebEx, Canvas Media Recorder, or Screencast-o-matic. You are responsible for identifying a tool and creating the presentation.

Project Design Principles

- **Mathematical Rigor:** Each project directly draws on concepts from *Mathematics for Machine Learning* (Deisenroth, Faisal & Ong, 2020).
- **Pedagogical Translation:** Students not only apply the mathematics but also design materials or activities suitable for teaching.
- **Practical Relevance:** Projects connect theory to real-world AI challenges, preparing MST graduates to inspire their own students with timely, interdisciplinary content.

Sample Project Options

1. Visualizing PCA with Real Data

Students implement PCA step by step, then design a visualization and classroom resource showing how dimension reduction works.

- 2. Exploring Optimization Through Linear Regression
 - Students fit a regression model, demonstrate gradient descent, and prepare a classroom demonstration linking calculus and optimization to AI.
- 3. Probability Meets AI Predicting Outcomes
 - Students apply conditional probability and Bayes' theorem to real-life contexts, comparing theory with simulation, and design a teaching activity on probability in Al.
- 4. **Neural Networks in Action From Logistic Regression to a Simple Classifier** Students build a simple neural network, explain backpropagation, and create an accessible demo for classroom use.
- 5. Al in Society Teaching Fairness through Mathematics
 Students analyze bias in a dataset, explore fairness metrics, and design a teaching activity on ethics and mathematics in Al.

Journal: GeoGebra Book (40%)

In this course you will create a separate GeoGebra book that will include your constructions and exercises from my lectures as well as the homework exercises from the textbook. In general, the textbook exercises that you are to complete will be started with an (*) which indicates that you need to use GeoGebra. Additionally, you will be asked to create a glossary for each module of terms and definitions. In general, within each Chapter, each individual exercise or example should have its own page, where you complete the construction or exercise and answer the

question(s). You are to include the question(s) and answer(s) onto each corresponding page. The format of the Journal will go as follows:

You will have 3 Chapters per Module:

- A Chapter for examples from the lecture.
- A Chapter for exercises from the textbook.
- A Chapter for vocabulary which will act as a glossary of terms and definitions.

Final Reflection Examinations (10%)

For the final reflection you will be asked to reflect on how you can apply the information learned in this course to your discipline. This reflection should be substantive enough to explain what was learned in the course as well as providing a practical application to teaching or your discipline. You may be asked to share your experience throughout the course on how this course has impacted your teaching and learning overall.

GRADE SCALE

Grad e	Weight (%)
Α	100 % – 94.0 %
A-	< 94.0% – 90.0 %
B+	< 90.0% – 87.0 %
В	< 87.0 % – 84.0 %
B-	< 84.0 % – 80.0 %
C+	< 80.0 % – 77.0 %
С	< 77.0 % – 74.0%
C-	< 74.0 % – 70.0%
D+	< 70.0 % – 67.0%
D	< 67.0 % – 64.0%
D-	< 64.0 % – 61.0%
F	< 61.0 % - 0.0%

LATE ASSIGNMENTS POLICY

Please note that students cannot be penalized for absences due to participation in University-approved activities, including athletic or scholastics teams, musical and theatrical performances, and debate activities. Instructors must allow these students to make up missed work without any reduction in the student's final course grade. Reasonable accommodation must also be made for students participating in a religious observance.

MAKE-UP POLICY FOR TESTS

Contact Instructor at the beginning of the term.

INCOMPLETE GRADE POLICY

The University policy states that a student who is passing a course but has not completed all work due to exceptional circumstances, may, with consent of the instructor, temporarily receive a grade of incomplete ("I"). The assignment of the "I" grade is at the discretion of the instructor but is allowed only if the student is passing the course.

COURSE POLICIES

CODE OF ACADEMIC INTEGRITY POLICY STATEMENT

Students at Florida Atlantic University should endeavor to maintain the highest ethical standards. Academic dishonesty is 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 to 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 <u>University Regulation 4.001</u>.

PLAGIARISM

<u>Plagiarism</u> is unacceptable in the University community. Academic work must be an original work of your own thought, research, or self-expression. When students borrow ideas, wording, or organization from another source, they must acknowledge that fact in an appropriate manner. Plagiarism is the deliberate use and appropriation of another's work without identifying the source and trying to pass off such work as one's own. Any student who fails to give full credit for ideas or materials taken from another has plagiarized. This includes all discussion board posts, journal entries, wikis, and other written and oral presentation assignments. If in doubt, cite your source.

ONLINE ATTENDANCE POLICY

Since the course is online, you should access the course at least three times per week to ensure you do not miss pertinent postings, messages, or announcements. It is imperative that you meet course deadlines and stay active in discussion boards, group projects, etc. If you are experiencing major illness, absences due to University duties, or other large-scale issues, contact the instructor immediately to formulate a resolution.

SPECIAL COURSE REQUIREMENTS

You must be able to use and access GeoGebra.

NETIQUETTE

Due to the casual communication common in the online environment, students are sometimes tempted to relax their grammar, spelling, and/or professionalism. Please remember that you are adult students and professionals—your communication should be appropriate. For more indepth information, please see the <u>FAU statement on netiquette</u>.

CLASSROOM ETIQUETTE/DISRUPTIVE BEHAVIOR POLICY STATEMENT

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.

COMMUNICATION POLICY

EXPECTATIONS FOR STUDENTS

Announcements

You are responsible for reading all announcements posted by the instructor. Check the course announcements each time you log in.

Email/Video Conferencing

You are responsible for reading all your course email and responding in a timely manner.

Course-Related Questions

Post course-related questions to the FAQ discussion board. This allows other participants with the same question to benefit from the responses. Also, make sure you review this forum prior to posting a question. Someone may have already asked and answered the question in previous posts.

INSTRUCTOR'S PLAN FOR CLASSROOM RESPONSE TIME & FEEDBACK

Email/Video Conferencing Policy

Except for weekends and holidays, the instructor will typically respond to email (Canvas inbox or FAU email) within 48 hours. You should ask course-related questions in the FAQ discussion board. If you have questions of a personal nature, you should email the instructor.

Assignment Feedback Policy

The instructor will provide feedback on submitted assignments within one week of the submission date. Some assignments may require a longer review period, which the instructor will communicate to you.

Assignment Feedback Method

Feedback will be given, i.e. immediate or automated feedback and comments through speed grader.

Course-Related Questions Policy

Except weekends and holidays, the instructor will generally answer questions within 48 hours.

Electronic Communication Policy

In addition to the University's policy, please consider the following:

- Privacy, confidentiality, and security in all electronic communications.
- All electronic communication resources must be used for the course and in alignment

- with to the University mission.
- Prohibited use of false identity, false identity pseudonyms, or anonymous (sender's name or electronic identification is hidden).
- Access without consent.
- Disruption of services including introducing computer contaminants (viruses).
- Harassment of any kind.

Please see the Office of Information Technology's policies on Cyber Security Awareness.

SUPPORT SERVICES & ONLINE RESOURCES

- Center for eLearning and Student Success
- Counseling and Psychological Services
- FAU Libraries
- Freshmen Academic Advising Services
- Math Learning Center
- Office of Information Technology Helpdesk
- Office of International Programs and Study Abroad
- Office of Undergraduate Research and Inquiry
- <u>Student Accessibility Services</u>
- University Center for Excellence in Writing

FACULTY RIGHTS & 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*.

SELECTED UNIVERSITY & COLLEGE POLICIES

ACCESSIBILITY POLICY STATEMENT

In compliance with the Americans with Disabilities Act (ADA), students who require special accommodations to properly execute coursework due to a disability, must register with Student Accessibility Services (SAS) located in the Boca Raton, Davie, and Jupiter campuses and follow all SAS procedures. For additional information, please consult <u>Student Accessibility Services</u>.

Contact

• **Boca Raton:** (561) 297-3880

Fax: (561) 297-2184, TTY: 711

• **Davie:** (954) 236-1222

Fax: (954) 236-1123, TTY: 711

• **Jupiter:** (561) 799-8721

Fax: (561) 799-8721, TTY: 711

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 <u>Academic Policies and Regulations</u>.

University Approved Absence Policy Statement

In accordance with rules of the Florida Atlantic University, students have the right to reasonable accommodations to participate in University approved activities, including athletic or scholastics teams, musical and theatrical performances and debate activities. It is your responsibility to notify the instructor at least one week prior to missing any course assignment.

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 <u>FAU Registrar Office</u> for more information.

* * *

The instructor reserves the right to adjust this syllabus as necessary.

Supporting letter from EECS

Subject: Re: a few items

From: Hari Kalva <hkalva@fau.edu>

Date: 9/8/2025, 2:00 PM

To: Yuan Wang < YWANG@fau.edu>

Hi Yuan, we support all the three proposed items:

- a revision of the Math track of the Cyber Security Graduate Certificate by adding a few elective courses in the Math course list
- a proposal of new graduate course Mathematical Foundation of Post-Quantum Cryptography
- a proposal of new graduate course Mathematics for Artificial Intelligence (primary audience will be teachers in mathematics)

I will take care of CAP 5768 for Spring 26.

Thank you.

From: Yuan Wang <YWANG@fau.edu> Sent: Sunday, September 7, 2025 2:50 PM

To: Hari Kalva <hkalva@fau.edu>

Subject: Re: a few items

Dear Hari,

I'm very sorry, but I attached in my previous email a wrong version the course proposal for Math Foundation of Post-Quantum Cryptograhy so the syllabus was missing. Please use the file in this email.

For your convenience, I'm including the other two attached files in this email.

Thank you.

Yuan

On 9/7/2025 1:59 PM, Yuan Wang wrote:

Dear Hari,

I hope all has been going well with you.

I have a few items for your attention:

• For Spring 2026, we do not plan to offer a section of CAP 5768. Could you please

Re: a few certificate programs

Subject: Re: a few certificate programs

From: Michelle McGovern < mvaugha3@fau.edu>

Date: 9/9/2025, 12:04 PM

Support from Curriculum and Instruction on:

• New Course: Mathematics for AI

• New Certificate: Teaching Geometry

New Certificate: Integrating Technology in the Math Classroom

New Certificate: Data Science for Math Educators

To: Sabrina Sembiante <ssembiante@fau.edu>, Yuan Wang <YWANG@fau.edu>

CC: Katarzyna Winkowska-Nowak <kwinkows@fau.edu>

Thank you for sharing these, they look like exciting new programs. We are happy to support your efforts.

Best of luck.

Michelle Vaughan-McGovern

Interim Co-Chair and Professor Curriculum and Instruction 777 Glades Road Boca Raton, FL 33431 Work-phone: <u>561-297-6594</u>

mvaugha3@fau.edu

https://www.fau.edu/education/faculty/mvaugha3/

FAU College of Education

From: Yuan Wang < YWANG@fau.edu>

Sent: Monday, September 8, 2025 5:12 PM

To: Sabrina Sembiante <ssembiante@fau.edu>; Michelle McGovern <mvaugha3@fau.edu>

Cc: Katarzyna Winkowska-Nowak <kwinkows@fau.edu>

Subject: a few certificate programs

Dear Dr. Sembiante and Dr. Vaughan-McGovern,

I'm reaching out to ask if you would be willing to support three of our newly proposed graduate certificate programs and a new course proposal. Please see the attached documents for your review.

The three certificate programs and the new course are designed primarily for student in the Master of Science in Teaching Mathematics (MST) program, as well as for active educators who want to enhance their teaching skills.

We would greatly appreciate your support. Please let me know if you have any questions or would like to discuss any aspect further.

Best regards, Yuan

cc. Dr. Katarzyna Winkowska-Nowak, Director of MST

Yuan Wang, Professor and Chair Department of Mathematics & Statistics Florida Atlantic University

1 of 1 9/15/2025, 8:32 AM cancel or hold CAP 5768-001, under Chang? We plan to offer a section in Spring 2027. I hope this is okay with you.

- I'm seeking your support on the following:
 - a revision of the Math track of the Cyber Security Graduate Certificate by adding a few elective courses in the Math course list
 - a proposal of new graduate course Mathematical Foundation of Post-Quantum Cryptography
 - a proposal of new graduate course Mathematics for Artificial Intelligence (primary audience will be teachers in mathematics)

The proposals, including the course syllabus, are attached. Your feedback and support would be greatly appreciated!

Thank you. Yuan