FLORIDA ATLANTIC UNIVERSITY

NEW COURSE PROPOSAL
Undergraduate Programs

Department Ocean and Mechanical Engineering

College College of Engineering & Computer Science

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

UUPC Approval 12/01/25
UFS Approval _____
SCNS Submittal _____
Confirmed _____
Banner Posted _____
Catalog _____

Prefix ETM

Number 4404

(L = Lab Course; C = Combined Lecture/Lab; add if appropriate)

Lab Code

Type of Course
Lecture

Course Title
Engineering Mechanics with Machine Learning

Credits *(Review Provost Memorandum)*
3

Effective Date *(TERM & YEAR)*
Fall 2026

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

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

This course introduces students to solving core problems in engineering mechanics using various machine learning techniques. The emphasis is on real-world applications of fluid dynamics, structural mechanics, and controls of mechanical systems.

Prerequisites, with minimum grade*

EEL 2161 OR EGN 2213 (minim. C)
EGN 3321 (minim C)
EGN 3331 (minimum C)

Corequisites
None

Registration Controls *(Major, College, Level)*
Major: OE or ME

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 GE Guidelines.

Minimum qualifications to teach course

FAU Faculty in Engineering Mechanics or related field

Faculty Contact/Email/Phone

Siddhartha Verma, vermas@fau.edu, 2248183449

List/Attach comments from departments affected by new course

The course was brought to the attention of the EECS department chair (Dr. H. Kalva).

Approved by		***Date***
Department Chair	Pierre Philippe Beaujean	11/10/2025
College Curriculum Chair	Yalan Liu	11/20/25
College Dean		11-25-25
UUPC Chair	Korey Sorge	12/01/25
Undergraduate Studies Dean	Dan Messroff	12/01/25
UFS President		
Provost		

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

FLORIDA ATLANTIC UNIVERSITY

ETM 4404

Engineering Mechanics with Machine Learning

Date: TBD

Building: TBD **Room:** TBD

3 Credit(s)

Fall/Spring 20xx - 1 Full Term

Instructor Information

Siddhartha Verma

Email: vermas@fau.edu

Office: ST 235

Office Hours: By Appointment

Phone: 954.924.7202

TA Name: N/A Office:

Office Hours:

Telephone:

Email:

Course Description

Engineering Mechanics with Machine Learning

Prerequisite: Major in OE or ME; EEL 2161 (C for Eng) **or** EGN 2213 (Comp Apps 1); EGN 3321 (Dynamics); EGN 3331 (Strength of Materials), all with a minimum grade of "C".

This course introduces students to solving core problems in engineering mechanics using various machine learning techniques. The emphasis is on real-world applications of fluid dynamics, structural mechanics, and controls of mechanical systems.

Prerequisites/Corequisites

Prerequisite(s): The following courses:

- EEL 2161 (C for Eng) **or** EGN 2213 (Comp Apps 1). (Minimum Grade of C)
- EGN 3321 (Dynamics). (Minimum Grade of C)
- EGN 3331 (Strength of Materials). (Minimum Grade of C)

Required Texts/Materials

No Required Textbook. The course will use the instructor's notes and freely available online material.

Optional recommended textbooks:

1. Engineering optimization: Theory and practice - https://fau-flvc.primo.exlibrisgroup.com/permalink/01FALSC_FAU/1m3tu56/alma991001529829806568
2. Machine Learning for Engineers - https://www.cambridge.org/highereducation/books/machine-learning-for-engineers/7FD8622836CAFCF5EDB169E7DC8A1ED4#overview
3. Machine Learning: A first course for engineers and scientists - https://www.cambridge.org/highereducation/books/machine-learning/30AC30764CCF1ACBF86188BECD1B00AE#overview

Course Objectives/Student Learning Outcomes

The objective of the course is to provide the students with an ability to apply basic and advanced machine learning techniques to a variety of engineering mechanics problems. By the end of this course, students should have:

1. A broad appreciation of modern machine learning concepts and their relevance to engineering mechanics problems.
2. The ability to connect data-driven approaches with traditional physics-based modeling in fluids, structures, materials, and environmental systems.
3. Experience with software tools and programming environments (primarily Matlab, and Python to some extent) for applying ML methods to real engineering datasets.
4. Skills to critically evaluate the performance, assumptions, and limitations of machine learning techniques in engineering contexts.
5. Effective communication through written reports, figures, and oral presentations.
6. Awareness of ethical, societal, and professional issues associated with the application of ML in engineering practice.

Student Learning Outcomes:

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

1. Apply fundamental machine learning techniques to solve mechanics-related problems in fluids, structures, materials, and environmental/ocean systems. (ABET **1**, 2, 6)
2. Analyze and evaluate engineering data and machine learning models, assessing accuracy, limitations, and physical plausibility. (ABET 1, 4, **6**, 7)
3. Communicate and collaborate effectively through technical reports, presentations, and team-based projects. (ABET 3, **5**)
4. Recognize ethical and professional responsibilities in the use of machine learning for engineering practice. (ABET **4**)

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 theStudent 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

Weekly homework to be submitted online on Canvas, graded on a scale of 0 to 2. Two to three in class quizzes will be administered during the term (announced at least a week in advance). There will be a mid-term exam halfway through the course. A group project involving data collection/analysis and a written report will be due before the final exam. Part of the project grade will be based on peer evaluation.

Homework 15%

Quizzes 20%

Midterm 20%

Group Project 15%

Final Exam 30%

Extra Credit: 5%

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 nonattendance. 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 outof-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	95 - 100%
A-	90 - 95%
B+	85 - 90%
B	80 - 85%
B-	75 - 80%
C+	70 - 75%
C	65 - 70%
F	Below 65%

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

Late work will not be accepted unless there is compelling evidence of a medical or otherwise serious emergency that prevented the student from completing the assignments on time. Incomplete grades are against the policy of the department. Unless there is solid evidence of medical or otherwise serious emergency situation, incomplete grades will not be given.

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. Recording class activities other than class lectures, including but not limited to student presentations (whether individually or as part of a group), academic exercises involving student participation, test or examination administrations, 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.

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 therapy, group therapy, and crisis 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
- Office of Information Technology Helpdesk
- Center for Global Engagement
- Office of Undergraduate Research and Inquiry (OURI)
- Student Accessibility Services
- Student Athlete Success Center (SASC)
- Testing and Certification
- Test Preparation
- University Academic Advising Services

The Center for Teaching and Learning (CTL)

The CTL has a variety of FREE TUTORING and other academic support services to help you succeed in your courses. You are encouraged to build your academic support team early in the term and meet with your team regularly. At the CTL, you can practice difficult course content, develop skills, and learn academic success strategies -- in person and online. Learn more about FAU academic support at **www.fau.edu/ctl**.

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**

Course Topical Outline

Topics:

1. **Materials Behavior and Performance Prediction**
   Applications: Stress–strain modeling, fatigue life estimation, fracture prediction.
   Techniques: Regression, random forests, feed forward neural networks.
2. **Structural Analysis and Damage Detection**
   Applications: Bridge vibration monitoring, aircraft wing health, predictive maintenance.
   Techniques: Classification (SVM, logistic regression), clustering, ensemble methods.
3. **Ocean and Environmental Systems**
   Applications: Storm surge prediction, wave run-up modeling, coastal erosion analysis.
   Techniques: Dimensionality reduction (PCA, SVD), time-series models (RNNs, LSTMs).
4. **Fluid Dynamics and Thermodynamic Systems**
   Applications: Data-driven flow prediction, flow field reconstruction, flight dynamics and flow control, propulsion performance modeling.
   Techniques: Deep learning (CNNs, RNNs), reduced-order modeling, reinforcement learning.
5. **Optimization and Engineering Design**
   Applications: Airfoil and wing shape optimization, lightweight structural design, offshore system optimization.
   Techniques: Gradient descent, Genetic Algorithms, CMA-ES.
6. **Limits and Ethics of ML in Mechanics**

Exam Dates

Mid-term Exam: TBD

Final Exam: TBD

Title IX Statement

In any case involving allegations of sexual misconduct, you are encouraged to report the matter to the University Title IX Coordinator in the Office of Civil Rights and Title IX (OCR9). If University faculty become aware of an allegation of sexual misconduct, they are expected to report it to OCR9. If a report is made, someone from OCR9 and/or Campus Victim Services will contact you to make you aware of available resources including support services, supportive measures, and the University's grievance procedures. More information, including contact information for OCR9, is available at **https://www.fau.edu/ocr9/title-ix/**. You may also contact Victim Services at **victimservices@fau.edu** or 561-297-0500 (ask to speak to an Advocate) or schedule an appointment with a counselor at Counseling and Psychological Services (CAPS) by calling 561-297CAPS.