Python with AI Applications in MAE

EGN 4930   Section 5198
Class Periods: Tues., Period 5-6, 2:00pm – 4:45pm and Thur., Period 6, 3:30pm – 4:45pm
Location: LAR 0330
Academic Term: Summer 2022

Instructor:

Kimberly Stubbs
kimberlyjstubbs@ufl.edu (Canvas messaging is preferred)
904-505-0714 (cell)
Office Hours: TBD, MAE-B 325B or on Zoom by appointment

Teaching Assistant:

Please contact me through the Canvas website
- Austin Moss, amoss93@ufl.edu, TBD, Zoom or in-person by appointment

Course Description

Variable content in mechanical engineering not offered in other courses.

Course Pre-Requisites / Co-Requisites

Engineering major of junior standing or higher.

Course Objectives

By the end of the semester, students enrolled in the course should have a functional understanding of the following:
- The basic Python language, including syntax, development environments, data types, control flow, functions/classes, file handling, best practices, etc.
- The core Python modules used in scientific computing, including NumPy, Matplotlib, Pandas, and SciPy.
- How to explore the wide expanse of open-source tools and documentation.
- An introduction to several Python tools and applications for AI / Machine Learning.

Materials and Supply Fees

N/A

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	Medium
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	
3. An ability to communicate effectively with a range of audiences	Low
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	Low

6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	Medium
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	High

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Required Textbooks and Software
- Software
  - Anaconda 3
  - Available for download at https://www.anaconda.com/products/distribution.
- No required textbooks
- Lecture notes are heavily derived from the SciPy Lecture Series
  - https://scipy-lectures.org/
  - A PDF copy of the full SciPy Lecture Notes is available on the Files page in Canvas.

Recommended Materials
- *Fluent Python: Clear, Concise, and Effective Programming*
- Luciano Ramalho
- ISBN: 978-1492056355

- *Python Machine Learning*
- Sebastian Raschka
- ISBN: 978-1789955750

Course Schedule
Subject to revision during the semester by the instructor

Week	Date	Topic
1	5/10/2022	Syllabus, Why Python?
		The Python language: First Steps & Basic Types
	5/12/2022	The Python language: Control Flow
2	5/17/2022	The Python language: Defining Functions
		The Python language: Scripts & Modules
	5/19/2022	The Python language: Standard Library
3	5/24/2022	The Python language: Exception Handling & OOP
		NumPy: The Array Object
	5/26/2022	NumPy: The Array Object (cont.)
4	5/31/2022	NumPy: Numerical Operations on Arrays
		NumPy: Numerical Operations on Arrays (cont.)
	6/2/2022	NumPy: Advanced Operations
5	6/7/2022	Matplotlib: Simple Plot
		Matplotlib: Figures, Subplots, and Ticks
	6/9/2022	Symbolic Math, Image Processing, 3D Plotting (overview)

6	6/14/2022	Pandas: Statistics in Python
		Pandas: Statistics in Python (cont.)
	6/16/2022	**Mid-term**
	Summer Break	
7	6/28/2022	Mid-term Overview
		SciPy: I/O and Linear Algebra
	6/30/2022	SciPy: Interpolation, Optimization, and Fit
8	7/5/2022	SciPy: Statistics and Numerical Integration
		SciPy: FFTs, Signal Processing, and Image Manipulation
	7/7/2022	Introduction to AI / Machine Learning
9	7/12/2022	Basic principles
		Supervised Learning
	7/14/2022	Supervised Learning: Classification
10	7/19/2022	Supervised Learning: Regression
		Measuring Performance
	7/21/2022	Unsupervised Learning: Dimensionality Reduction
11	7/26/2022	Unsupervised Learning: Visualization
		Eigenfaces example
	7/28/2022	Parameter selection, Validation, and Testing
12	8/2/2022	Machine Learning in Controls
		Machine Learning in Controls (cont.)
	8/4/2022	Course Wrap-up

Attendance Policy, Class Expectations, and Make-Up Policy

Attendance is highly encouraged. However, lectures will be recorded and can be watched later if attendance is not possible. Students are responsible for knowledge of all scheduling and policy announcements made in class. All assignments, projects, and exams should be written in a profession manner and illustrate that you understand the core concepts being covered while meeting the following guidelines.

- All homework will be turned in electronically via the class Canvas web site. Assignments that are submitted after the due date and time, but before the assignment closure date and time (usually, but not always, 2 days after the due date) will be deducted 25%. Only files that are uploaded will be graded. All submissions must be your own work produced exclusively for this course.

- Assignments and/or exams that are missed due to excused absences in compliance with the university policies defined in the Undergraduate Catalog (link below) will be granted special accommodations for make-up work. To qualify, appropriate documentation is required.

- For all assignments that require submission of code, turn in easy to read, easy to run, and well commented Python 3.8+ code produced within Jupyter Notebook. Points will be lost if code cannot be run or easily understood.

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies. Click here to read the university attendance policies: https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homework/Small Projects (8)	10 each	40%
Midterm Exam	100	20%
Final Project	100	30%
Review Paper	100	10%
		100%

Grading Policy

Percent	Grade	Grade Points
93.4 – 100	A	4.00
90.0 – 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
55.0 - 59.9	E	0.00

More information on UF grading policy may be found at:
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Students Requiring Accommodations
Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting https://disability.ufl.edu/students/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation
Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

In-Class Recording
Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in

connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

University Honesty Policy
UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Conduct Code (https://sccr.dso.ufl.edu/process/student-conduct-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment
The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:
• Your academic advisor or Graduate Program Coordinator
• Jennifer Nappo, Director of Human Resources, 352-392-0904, jpennacc@ufl.edu
• Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
• Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use
All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy
There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: https://registrar.ufl.edu/ferpa.html

Campus Resources:

Health and Wellness

U Matter, We Care:
Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: https://counseling.ufl.edu, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence
If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

COVID-19
- You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated.
- If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email covid@shcc.ufl.edu) to be evaluated for testing and to receive further instructions about returning to campus.
- If you are withheld from campus by the Department of Health through Screen, Test & Protect, you are not permitted to use any on campus facilities. Students attempting to attend campus activities when withheld from campus will be referred to the Dean of Students Office.
- UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the UF Health Screen, Test & Protect website for more information.
- Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling; https://career.ufl.edu.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus*: https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/;https://care.dso.ufl.edu.

On-Line Students Complaints*: http://www.distance.ufl.edu/student-complaint-process.