Computer Model Formulation

COT3502 Class # 29164
Class Periods: Tuesday / Thursday, Period 6-7, 12:50 PM - 2:45 PM
Location: FLG 280
Academic Term: Spring 2024

Instructor:
Prof. Tony Ladd
tladd@ufl.edu
Office Hours: Wednesday 4:00 PM – 6:00 PM, ChE 225

Teaching Assistant:
Please contact through the Canvas website
- jasmeetbhatt@ufl.edu: Recitation Monday 4-6pm. Location TBA

Course Description
Solutions of scientific and engineering problems using digital computers. Formulation of models for describing physical processes, numerical analysis and computer programming. (4 credits).

Course Pre-Requisites / Co-Requisites
ECH 3023 and MAP 2302 and MAC 2313

Course Objectives
Formulate mathematical process models.
Solve mathematical models using analytical methods.
Solve mathematical models using numerical methods.
Write computer programs to solve mathematical models.

Materials and Supply Fees
N/A

Resources and Software

- Python(Anaconda) download https://www.anaconda.com/download
- Online tutorials and reference https://www.w3schools.com/python
- Official numpy documentation https://numpy.org/doc/
- Official scipy documentation https://docs.scipy.org/doc/scipy/
- Notes on numerical methods by Ian Hawke (PDF on Canvas) - 2nd half of class
- Project Euler: contains a large number of short (but sometimes difficult) coding problems. Some homework problems are taken from this site. https://projecteuler.net/

Course Schedule

Week 1: **Introduction to Python Programming**
Algorithms and programs
Python and the Spyder GUI
Basic data types and operators
Expressions and assignments

Week 2: Logical expressions and conditionals
Loops
Following the code and debugging

Week 3: Compound data types: Strings, lists and tuples
Type conversions

Week 4: Functions and modules

Plotting in matplotlib
(Start) Project 1: Spirographs

Week 5: Series and summations
Objects, namespaces, and function scope

Week 6: Recursion and iteration
Algebraic equations I

Week 7: Midterm review
Midterm: Thursday, February 22nd Periods 6 & 7

Week 8: Algebraic equations II
Introduction to numpy

Week 9: Numpy programming
Numerical quadrature

Week 10: **ODEs: Initial-value problems:**
Differential equations and initial conditions
Numerical differentiation
Euler & Heun methods

Week 11: Runga Kutta methods
Solving coupled ODE's with numpy
Predator-Prey model

Week 12: **PDEs**
Finite difference method
Heat conduction
Explicit PDE's

Week 13: Discretization in 2D
Euler and higher order methods
(Start) Project 2: Grey-Scott model

Week 14: Implicit PDEs
Reduction to algebraic equations
Review

Week 15: **Final: Tuesday, April 23rd Periods 6 & 7**

Attendance Policy, Class Expectations, and Make-Up Policy

- Attendance of lectures is highly recommended. We will work on programming, group problems, and examples interactively in class together.
- Students will be assigned homework on Wednesday of each week; they are due the following Wednesday evening before the start of the TA's office hours (exact time of TA's office hours each Wednesday evening will be determined in class and posted on Canvas). As the TA may go over homework problems in class, late homework cannot be accepted – don't wait until the last minute! Homework assignments are due via file uploads on Canvas. Only selected problems will be graded each week.
    - Note: The lowest homework grade will be dropped – therefore, if you are late for one of the assignments it won't hurt your homework grade.
- There will be several quizzes in class throughout the semester. Students will be given at least 2 days notice prior to any in class quizzes
- There will be two in-class exams (~90 mins). Details of the exam format will be given in class prior to the exam.
- You are responsible for all announcements made in class.
- Requests for make-up exams will be considered only for those students who missed due to an acceptable reason as listed in the undergraduate catalog (link below). For all planned or unplanned absences, the student should inform the instructor as soon as possible according to the guidelines in the undergraduate catalog (link below).
- Students arriving late for an exam will be given only the balance of time remaining to complete their work unless an acceptable reason (see above) is provided.
- Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies, as found on this link:
  https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/

- **Plagiarism Policy**:

  Submitting work for credit that is not your own is called plagiarism; it applies to any graded assignment or test. Plagiarism is a violation of the UF code of conduct and can lead to academic, educational, and status sanctions, up to and including expulsion.

  For the purposes of this class, plagiarism includes, complete codes or flowcharts, or substantial portions of a code. Blocks of code implementing identical logic can also be plagiarism even if names and ordering of the code has been changed. Plagiarism includes copying from other students, copying work done in previous years or other classes, or from the internet. Note that plagiarism applies to both the source and the receiver of code.

  Code fragments – for example a "for" or "if" construct – would not, in isolation, constitute plagiarism. Neither would ideas or code shared by an instructor. Nevertheless, distributing code shared with you individually to other students might constitute plagiarism. Reusing code of your own from previous assignments does not constitute plagiarism. Neither does using source codes posted by the instructors.

  Tips to avoid accusations of plagiarism:

  I. Do the coding yourself.
  II. If you do use sources – cite them as notes to the submission.
  e.g. lines 11-13 copied from https://stackoverflow.com/questions/….
  or idea for lines 11-13 found at https://stackexchange.com/...
  III. Its OK to get help ; if an instructor shows you something it will not be plagiarism if you use the idea.
  IV. If you distribute copies of code, it can be considered plagiarism.
  V. You can discuss problems with others, but you should write the code alone.
  VI. If in doubt ask.

VII. Responsibility for academic honesty violations is made based on the evidence presented at an SCC hearing. The burden of proof is an administrative one - "more likely than not" rather than the criminal one "beyond all reasonable doubt".

Evaluation of Grades

Assignment	Percentage of Final Grade
Homework*	15%
Project 1	10%
Project 2	15%
Quizzes*	10%
Exam 1	25%
Exam 2	25%

*The lowest grade will be dropped.

Grading Policy

The grading scale for the course will be as follows:

Percent	Grade	Grade Points
90-100	A	4.00
85-89.9	A-	3.67
80-84.9	B+	3.33
75-79.9	B	3.00
70-74.9	B-	2.67
65-69.9	C+	2.33
60-64.9	C	2.00
55-59.9	C-	1.67
50-54.9	D+	1.33
45-49.9	D	1.00
40-44.9	D-	0.67
0-39.9	E	0.00

Instructor may lower the threshold for attaining the letter grades specified above (to the benefit of the students).

More information on UF grading policy may be found at:
https://catalog.ufl.edu/UGRD/
Grades and Grading Policies

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the Disability Resource Center (352-392-8565, https://www.dso.ufl.edu/drc). 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.

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

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 Honor Code (https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

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:
http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html

Campus Resources:

Health and Wellness

U Matter, We Care:
If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.

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

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/.

Academic Resources

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://www.crc.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://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf

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