

Computer Model Formulation

COT3502 Section 0098

Class Periods: TR, periods 6-7, 12:50 AM-2:45 PM

Location: Zoom (Links on Canvas)

Academic Term: Spring 2021

Instructor:

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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

ECH 3023, 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

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	High
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	
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	
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

- 1 Automate the boring stuff with Python <https://automatetheboringstuff.com> (ABS.pdf)
- 2 Numerical Methods (Notes) by Ian Hawke (Hawke.pdf)
- 3 Python in easy steps
<https://www.amazon.com/Python-easy-steps-Covers-3-7/dp/1840788127> (PES)

Additional Materials

- Project Euler <https://projecteuler.net/> contains a large number of short (but sometimes difficult) coding problems. Some homework problems are taken from this site.

Course Schedule (preliminary)

Week	Topic	Resources
1	Introduction to Python Programming Algorithms and programs Python and the Spyder GUI Basic data types and operators Expressions and assignments	PES 1 + tu1.pdf tu2.pdf + ABS 1 hw1.pdf
2	Logical expressions and conditionals Loops Following the code and debugging	PES 2 + tu3.pdf + ABS 2 tu4.pdf + tu5.pdf hw2.pdf
3	Compound data types: Strings, lists and tuples Type conversions	PES 3 + tu6.pdf hw3.pdf
4	Functions and modules Plotting in matplotlib Project 1: Spirographs	PES 4 & 5 + tu7.pdf + ABS 3 tu8.pdf + tu9.pdf hw4.pdf
5	Sample programs: series and summations More on loops - range function Objects, namespaces and function scope	PES 4 + tu10.pdf hw5.pdf
6	Introduction to numpy Numerical quadrature	tu11.pdf Hawke 4.3.1, 4.3.2 hw6.pdf
7	Random walks - diffusion equation Midterm Review (No class on 25th)	tu12.pdf
8	Midterm March 2 nd Periods 6 & 7 Agent Based Simulations Project 2	hw7.pdf

9		ODE's: Initial-value problems Differential equations and initial conditions Numerical differentiation Euler & Heun methods	tu13.pdf Hawke 5.1-5.4 hw8.pdf
10		Runga Kutta methods Solving coupled ODE's with numpy Predator-Prey model	Hawke 5.5 tu14.pdf hw9.pdf
11		ODE's: Boundary-value problems Finite difference method Heat conduction	Hawke 6.1 & 6.3 hw10.pdf
12		Non-Linear equations Bisection Newton method Secant method	Hawke 3.1, 3.2, 3.4.3, 3.4.4 hw11.pdf
13		Vectors and Matrices Matrix representation of linear equations Gauss elimination Linear algebra with the numpy.linalg library	Hawke 2.1, 2.2, 2.3.2 tu15.pdf hw12.pdf
14		Fitting data Least squares method	tu16.pdf hw13.pdf
15		Review for Final	

Attendance Policy, Class Expectations, and Make-Up Policy

- a Lectures and office hours will be carried out over Zoom. Schedules will be posted on Canvas. Lectures and recitations will be recorded and posted to a channel on the UF mediasite.
- b Students will be assigned homework by Monday of each week; they are due at 6pm on Wednesday of the following week. Late submissions will be penalized and no solutions will be accepted after midnight on the due day. Selected problems will be graded each week. Solutions to problems will be posted after they are graded. If the problem requires written work (such as a flowchart) scan the written document and upload it.
- c The midterm (120 mins) will be given during class periods, and the final exam (120 mins) during the period for scheduled Final. Tests will cover all the material from the previous ½ semester. They will be open book and open notes. You may use programs you have written previously, but internet access or other communication is prohibited. The exams will be proctored by Honorlock
- d You are responsible for all announcements made in class.
- e You are responsible for printing the assignments from the class web page located at <https://elearning2.courses.ufl.edu>.
- f Requests for re-grading of assignments and exams will only be considered within a one-week period from the time graded work is returned in class.
- g Scores will be posted on the web. Throughout the semester, you have to ensure that they are entered correctly. Corrections will be considered only within a one-week period after the grades have been posted on the web.
- h Students may request a makeup for any activity sponsored by the university, for health reasons and for family emergencies. Other reasons at the instructor's discretion. There will be no make up for the final exam except for health or family reasons. In such cases the student will receive an Incomplete with a makeup to be given the following semester.

Evaluation of Grades

Assignment	Percentage of Final Grade
Midterm Exam	25%
Final Exam	25%

Homework	15%
Project 1	15%
Project 2	20%
Total	100%

Grading Policy (approximate - subject to modification)

Percent	Grade	Grade Points
90-100	A	4.00
85-90	A-	3.67
80-85	B+	3.33
75-80	B	3.00
70-75	B-	2.67
65-70	C+	2.33
60-65	C	2.00
55-60	C-	1.67
50-55	D+	1.33
45-50	D	1.00
40-45	D-	0.67
0 - 40	E	0.00

Schedule of Assignments and Tests,

Homework	1/20, 1/27, 2/3, 2/10, 2/17, 2/24, 3/10, 3/17, 3/24, 3/31, 4/7, 4/14, 4/12 by 6 pm
Projects (2)	2/24, 3/31
Midterm	Tue Mar 2 nd Periods 6 & 7
Final	Mon Apr 26 th 7:30-9:30 am

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 requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure 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/>.

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://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-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.

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
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.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

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

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

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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://care.dso.ufl.edu>.

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