Computational Methods in Environmental Engineering

ENV 3040C, Section 3548
Class Periods: Tuesday/Thursday, Period 3, 9:35-10:25AM
Wednesday, Periods 8-10, 3:00-6:00PM
Location: Tuesday/Thursday ROG 110
Wednesday CHE 237
Academic Term: Spring 2020

Instructor:
Dr. Kathe Todd-Brown
kathe.toddbrown@essie.ufl.edu
352-294-6604
Office Hours: Friday 1:00-4:00PM; Tuesday/Thursday 10:30-11:30 Zoom (link found on Canvas site)

Teaching Assistant/Peer Mentor/Supervised Teaching Student:
Please contact through the Canvas website

- Ryan Platt rplatt@ufl.edu

Course Description

This course will introduce the fundamentals of computer programing, construction of numerical models, and interpretation of data within the context of numerical models. 3 Credits

Course Pre-Requisites / Co-Requisites

Prerequisite: MAC 2313 Analytic Geometry and Calculus 3
Corequisite: MAP 2302 Elementary Differential Equations

Course Objectives

Students will be able to generate data summary statistics and visualizations, develop models representing environmental processes, integrate models with data to extrapolate results, document reproducible analysis pipelines, and give/receive constructive feedback.

Materials and Supply Fees

Not applicable.

Professional Component (ABET):

This course contributes 3 credits towards engineering topics.

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	Medium
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	High
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Low

Required Textbooks and Software

- Open Source Software:
  - R (>3.5.3): A language and environment for statistical computing. R Core Team (2019). R Foundation for Statistical Computing, Vienna, Austria. URL: https://www.R-project.org/.
  - RStudio: Integrated Development for R. RStudio Team (2015). RStudio, Inc., Boston, MA URL http://www.rstudio.com/.
- Free software:
  - Zoom
- Course notes and material are developed by the instructor and will be made available on Canvas.

Recommended Textbooks and Software

- Wickham, H. Advanced R. (2019). 2nd Edition. ISBN-13: 978-0815384571. Available: https://adv-r.hadley.nz/
- Thomas Wright and Naupaka Zimmerman (eds): "Software Carpentry: R for Reproducible Scientific Analysis." Version 2016.06, June 2016, https://github.com/swcarpentry/r-novice-gapminder, 10.5281/zenodo.57520.

Course Schedule

Week 1-2: What is a computer? – Tools, a history of computing, logic, and Turing machines

Week 3: Text parsing and I/O – regular expressions and working with strings

Week 4-5: Discretizing the continuous – numerical precision, slicing, aggregation, event extraction, interpolation, and diffusion

Week 6-7: Mathematics as descriptions – Monotonic, saturation, catalytic, oscillating, polynomials, and diffusion

Week 8-9: Model-data integration – Convolution of functions, noise, measure functions and minimization

Week 10-11: Data exploration – Climatology

Week 12-13: Data exploration – Hydrology

Week 13-14: Data exploration – Biogeochemistry

Week 15: Final project due

Assignments will be due every other week starting week 3.

Attendance Policy, Class Expectations, and Make-Up Policy

Students are *responsible* for the material covered in class, however no attendance will be recorded. It is strongly recommended that students attend both lecture and labs.

Due to extenuating circumstances class has been ***moved online*** as of week 11 (transitioning week of March 10, 2020). The week's lectures will be recorded and posted online by Monday. *Students are expected to be on-line during regular class and lab hours* and logged into Zoom or similar classroom chat service. We will complete in class assignments, labs, and answer homework questions as a group in this virtual environment. Should Zoom experience significant outages due to increased traffic, we will use the Canvas chat room. Links will the posted on the class Canvas front page. Students are also encouraged to use the Discussion board on Canvas. The instructor will be available via Zoom or Canvas Chat during regular office hours, or other mutually convenient times.

Students are expected to contribute to a *distraction free* learning environment, and students responsible for disruptions in class may be asked to leave.

Students are expected to utilize their *laptops* or personal computers to attend class remotely. Students should also ensure they have administrator privileges on their computer and that they have installed Rstudio, R, and git.

Arrangements for *missed assignments* should be made as soon as possible (preferably in advance). Missed assignments, without prior arrangement, ~~fall under the following 'resubmission' policy except under extenuating circumstances~~ will require explicit exceptions for submission. Please contact the instructor.

Assignments can be *resubmitted* for complete credit at any point (this applies retroactively to assignments submitted earlier in the semester) with two exception. First, if the point difference between the previous two submissions is less then 5 points, you may not resubmit that assignment again. Second, the initial assignment must be submitted by the due date, unless you have an exception from the instructor. Assignments include the homework, data report and modeling case study, but do NOT include quizzes, labs, and lecture summary. Final due date for ALL resubmits is April 24th.

Data summaries are graded in stages. Initial scoping includes a preliminary report on a single data set and identification of additional data sets (10 points). First round of submissions includes summary of 3 data sets (15 points). Finished data report (45 points), note that resubmits are expected on the final data report and the due dates have been structured to reflect this.

A *modeling case study* is staged similarly to the data summary described above. Scenario or case study proposal (10 points). Initial scoping for the model with development case and initial parameter ranges (15 points). Finished modeling case study (45 points), note that resubmits are expected on the final modeling case study and the due dates have been structured to reflect this.

Lab reports (2 points each) and *quizzes* (10 points each) are due weekly beginning week 10. There is one guest *lecture summary* on week 15 (10 points).

Excused absences must be consistent with university policies in the undergraduate catalog (https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx) and require appropriate documentation.

Evaluation of Grades

Assignment	Count	Total points	Percentage of Final Grade
Homework Sets	3	300	57%
In-class Quiz	9	80	15%
In-class Labs	5	10	2%
In-class Lecture summary	1	10	2%
Data Report components	6	112	22%
Model proposal	1	10	2%
		522	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
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 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

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.

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/.

Academic Resources

E-learning technical suppor*t*, 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.

Change log:

April 16, 2020
- Update assignments to reflect removal of modeling report and addition of R script release
- Removal of highlighting for clarity

March 30, 2020
- Added additional office hours

March 28, 2020
- Updated resubmit and missed assignments policy
- Remove peer reviews from data and modeling summaries => reduced points

March 10, 2020
- Replaced data report with data set and model summaries
- Added quizzes and labs to the scores
- Added online expectations

February 3, 2020
- added Ryan Platt as Teaching Scholar for the class
- added required excused absence statement
- reduced number of homework assignments from 4 to 3.