CE 311K Introduction to Computer Methods
Fall 2019

Instructor	Krishna Kumar
Pronouns	He, him, his
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Office Hours	T 2:00-4:00 PM, Th 9:30-11:00 AM or by appointment
Lectures	TTH 08:00-09:30 AM in JGB 2.218
Laboratories	Unique #15040: F 2:00-4:00 PM in ECJ 2.210
	Unique #15045: W 3:00-5:00 PM in ECJ 2.210
	Unique #15050: T 4:00-6:00 PM in ECJ 2.210
	Unique #15068: F 12:00-2:00 PM in ECJ 2.210
Teaching Assistants	TBA
Textbooks	A formal textbook is not required for this course.
References	"Numerical Methods for Engineers: With Software and Programming Applications," S. C. Chapra, R. P. Canale, (any edition).
	"Numerical Python: Scientific Computing and Data Science Applications with Numpy, SciPy, and Matplotlib," R. Johansson, (2018).
Course website	Canvas https://canvas.utexas.edu
Prerequisites	CE 301 and credit or registration for M 408D or M 308L

Course Description

Welcome to CE 311K! CE 311K is a fundamental course that is required for both CE and ARE majors. The course provides an introduction to a programming language (Python) and numerical methods used to solve problems that arise in a variety of engineering disciplines. This course will help you develop problem-solving skills through the use of an organized and systematic approach that is essential for your success as an engineer.

This course has two primary objectives:
> (1) To introduce the basic elements of computer programming using Python, and
> (2) To introduce simple numerical methods for the solution of problems that typically arise in a variety of engineering disciplines.

Learning outcomes

1. Formulate engineering/mathematical problems in a structured form using pseudocode/algorithms
2. Develop computer programs for reading, manipulating, exporting and plotting data using the Python programming language to solve engineering problems
3. Quantify the space and time complexity of different computational algorithms and determine the appropriate algorithm for a given problem.
4. Evaluate the error involved in different numerical procedures.

These learning objectives will be assessed based on students' performance on exams and homework/laboratory assignments.

What will I learn?

Numerical methods are at the core of computational modeling techniques for solving engineering problems. You will learn how to solve engineering problems typically through four steps: (i) observations (possibly experimental); (ii) postulation of mathematical theories and associated models in accordance with the observations; (iii) solution of the mathematical models using numerical methods, and; (iv) validation of the obtained results via comparisons with the observations.

As computing power and numerical methods continue to improve, their impact on the future of engineering is significant. No matter what that future might turn out to be, it is very likely that computers and numerical methods will be a major part of it, at least for the near term. An introductory course in numerical methods and programming, as this one is, aims at exposing you to the fundamentals of numerical methods and programming so that as engineers you will be able to participate intelligently in the shaping of the future.

What main skills will I develop?
- Python programming and data analytics to analyze and solve complex problems,
- Project planning and organization skills to solve real-world engineering problems,
- Automate the boring stuff with Python.

How to learn and succeed in this course?

If you are new to programming, please practice, practice, practice! Programming cannot be passively absorbed as a skill, please download the code and lecture notes, and follow along in class. Working on assignments constitutes possibly the best way for digesting the material and learning the concepts (roughly speaking, most of us learn best by doing, rather than by listening or reading). So, please, consistently plan and complete the assignments throughout the semester. A study guide will be provided for your exams that will help you with focusing on the required content for your exams and explain what skills will be tested. I encourage you to use the opportunity to resubmit your assignments and projects for a full grade by fixing any errors/issues in your homework based on the instructor feedback.

Course schedule

The following is a tentative outline of the topics to be covered.

Introduction to computing
- Simulation
- Operating systems
- Roundoff and truncation errors

Python Programming
- A basic introduction to Python syntax
- Sequence, conditionals, repetition; input/output; arithmetic operations;
- Matrices and Arrays: scalar, vector, and matrix
- Array operations and functions
- Graphing
- Symbolic notations
- Data structures and algorithms

Numerical Methods
- Root Finding
- Curve Fitting
- Linear Systems
- Integration and Differentiation
- Ordinary Differential Equations
- Finite-difference schemes

Class participation is strongly encouraged. Do not hesitate to raise questions, ask for clarification, or suggest your own ideas during class. In addition, at all times you are invited to submit questions and comments on in person or on the forum (canvas) or via email. *Partially-filled lecture notes will be posted on Canvas before each lecture, I recommend having a copy (printed or digital) on hand during the lecture to take notes. Please do bring a computer to the lectures to follow along programming exercises using Jupyter Notebooks.*

Grading

Your grade (G) will be computed based on the following formula:

```
G = 0.12L + 0.1H + 0.08P + 0.22 max(E1, E2) + 0.18 min(E1, E2) + 0.3F
```

where, (L) stands for lab assignments and quizzes, (H) stands for homework, (P) stands for a project, (E1) and (E2) are two mid-course exams, and (F) is the final exam. Students who miss an examination will receive a grade of zero. Exceptions to this rule will be made only on a carefully considered basis, and only if the student contacts the instructor *before* the exam.

I encourage you to use the opportunity to resubmit all your assignments, projects, and exams (excluding the final exam) by fixing any errors within 1 week of grading, for full credit in the homework/projects and extra credits for exams. The maximum extra credit for corrections to your exams will be decided based on the class performance. Two exams conducted during the course of the semester will account for 40% of the credits. A weighted scoring will be used. The maximum score from the two exams is worth 22.5%, while the minimum score in those two exams will account for 17.5% of the course credits.

As I hope you can see, flexibility is built into the assignments and exams to support your success in this course. If you miss a smaller assignment or don't do as well on your earlier exam, your grade will not be impacted significantly. Consequently, the final grades are firm, and no additional curve is available.

Your letter grade cutoff (G):

	A 90%,	A- 87%,
B+ 84%,	B 80%,	B- 77%,
C+ 74%,	C 70%,	C- 67%,
D+ 64%,	D 60%,	D- 57%,
F <57%		

The scale shown above is based on minimum bounds. I reserve the right to change these bounds. Any adjustment to the bounds will depend on the class performance.

Grace policy (time-bank options)
Sometimes we have bad days, bad weeks, and bad semesters. In an effort to accommodate any unexpected, unfortunate personal crisis, I have built "time banks" into our course. You do not have to utilize this policy, but if you find yourself struggling with unexpected personal events, I encourage you to contact me as soon as possible to notify me that you are using our grace policy. You may use this policy one of two ways (please choose, and let me know):
> You may have a two-day grace period for one assignment, OR
> You may have 2 one-day extensions for two different assignments.

Course Attendance
Students are **expected to attend all class and laboratory periods.** Those who fail to attend class and laboratory regularly are inviting scholastic difficulty. Students are responsible for material identified in the readings and covered in class and laboratory, even if absent for authorized activities. If you are absent on the day that your team meets, you are responsible for providing your team with the necessary information to compensate for your absence. *It is crucial to keep in communication with your team members; you are responsible for letting both us and your team know if you cannot make it to a class.*

*Excused Absence***:** If you plan to miss class due to the observance of a religious holiday, please let us know at least two weeks in advance. You will still be responsible for any work you will miss on that day if applicable. Check with us for details or arrangements. For further information:
http://catalog.utexas.edu/general-information/academic-policies-and-procedures/attendance/

Course Assignments
Homework assignments will generally be assigned each week and will be due at midnight on the date specified. A *digital copy* must be submitted via Canvas to facilitate grading of Python programs. Late assignments will be accepted if turned in within 24 hours of the original due date/time. However, the final grade on any late assignments will be reduced by 20%. Assignments should be clearly and cleanly written. I expect all to adhere to a reasonable person's presentation standards. Assignments must include the relevant Python script(s), whenever applicable.

Course Examinations
There will be two exams given during the regularly scheduled lecture period. In addition to the material covered in the class lectures, the exams may include questions from your work in the laboratory portion of the class. All of the exams will be closed-book, closed-notes. However, you will be permitted to bring one sheet (8.5 x 11 inch) of your own handwritten notes to each

examination. The organizational effort required to do this is an effective means of reviewing the course content before the exam. In addition, you may need to bring a calculator to the exams.

All communication devices must be turned off and stored out of sight during exams. If you are caught using any electronic device other than a calculator for any reason during the exam you will receive a score of zero. The final examination will cover all of the material from the semester. As the final is comprehensive, you will be allowed to use the two handwritten note-sheets from your previous examinations plus one additional sheet for the material covered since the second exam. Following the university schedule, **the final exam will be held Tuesday, December 17, from 9:00-12:00**.

Laboratory
The laboratory sections meet in ECJ 2.210. The laboratory will enhance your understanding of the course material and provide a hands-on opportunity to program in Python. **Laboratory attendance is strongly encouraged,** and students will find it difficult to finish homework assignments and/or perform well on exams without attending the lab. Teaching assistants (TAs) will be assigned to each lab. The **TAs may administer unannounced quizzes at their discretion**. Additional laboratory policy and procedures will be discussed in greater detail during the first lab session.

Computing Resources
Students are expected to be familiar with the Learning Resource Center (LRC) on ECJ2.210. The LRC currently operates a large number of computers running the Windows operating system, which will be used for the course. Thus, familiarity with basic operations (file opening, printing, application launching, etc.) of the Windows environment is expected. Because the course is intended for students with no prior experience in scientific computing, knowledge of a specific programming language or mathematical software is not required.

The machines in the LRC contain all the necessary software needed to complete the course assignments. If you would like to utilize Python outside of the LRC, you have two options:

Local installation: Download and installed the Anaconda distribution from https://www.anaconda.com/download/ and utilize the Anaconda Navigator (https://docs.anaconda.com/anaconda/navigator/) to gain access to Jupyter.

Cloud access: Register for a DesignSafe account (https://www.designsafe-ci.org/account/register/) and access Jupyter through https://jupyter.designsafe-ci.org/. DesignSafe is a cyberinfrastructure web platform for natural hazards research that includes a data repository, access to high-performance computing, as well as a Jupyterhub. Students may also use https://repl.it/ an online Integrated Development Environment (IDE) for Python projects. UT has free access to Microsoft Azure services through: https://notebooks.azure.com.

Academic Integrity
Each student in the course is expected to abide by the University of Texas Honor Code: "*As a student of The University of Texas at Austin, I shall abide by the core values of the University and uphold academic integrity.*" **Plagiarism is taken very seriously at UT.** Therefore, if you use words or ideas that are not your own (or that you have used in the previous class), you must cite your sources. Otherwise, you will be guilty of plagiarism and subject to academic disciplinary action, including failure of the course. You are responsible for understanding UT's Academic Honesty and the University Honor Code: http://catalog.utexas.edu/general-information/appendices/appendix-c/student-discipline-and-conduct/

Students are strongly encouraged to discuss course topics among themselves since such discussions are an important part of the learning process. All work submitted for this class *must* be entirely your own. This requirement will be strictly enforced for examinations and homework assignments. In doing class assignments, you may consult with your fellow classmates regarding the most appropriate solution to a given problem. However, **each student must prepare his or her own, individual submission for each assignment**. For example, you are permitted to work together in deciding the best approach to an assigned problem, but everyone must work through the entire problem on their own; showing each step in the solution. **Identical copies of computer programs or data plots are not acceptable**. Working together on assignments should foster your understanding of the course material.

Deadlines and Drop Policy
From the 1st through the 12th class day, an undergraduate student can drop a course via the web and receive a refund, if eligible. From the 13th day of class day through the university's academic drop deadline, a student may Q drop a course with approval from the Dean, and departmental advisor. Students are strongly urged to make any changes in their course schedules during the first week of classes so that other students who need to add the course can be accommodated.

Course and Instructor Evaluation
A formal course and instructor evaluation will be conducted at the end of the semester using the approved UT Course/Instructor evaluation forms. Suggestions for improving the instruction and course content are welcome at any time during the semester and are particularly appreciated.

Statement on Learning Success
Your success in this class is important to me. We will all need accommodations because we all learn differently. If there are aspects of this course that prevent you from learning or exclude you, please let me know as soon as possible. Together we'll develop strategies to meet both your needs and the requirements of the course. I also encourage you to reach out to the student resources available through UT. Many are listed on this syllabus, but I am happy to connect you with a person or Center if you would like.

Statement on Inclusive Classroom
I consider this classroom to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability - and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every member of the class.

Personal pronoun use (She / He / They / Ze / Etc)
Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender, gender variance, and nationalities. Class rosters are provided to the instructor with the student's legal name unless they have added a "preferred name" with the Gender and Sexuality Center (http://diversity.utexas.edu/genderandsexuality/publications-and-resources/). I will gladly honor your request to address you by a name that is different from what appears on the official roster, and by the

gender pronouns you use (she/he/they/ze, etc). Please advise me of any changes early in the semester so that I may make appropriate updates to my records.

University Resources for Students
University policies: For other university policies not explicitly included in this syllabus, please consult the General Information Catalog: http://catalog.utexas.edu/general-information/.

Services for Students with Disabilities
This class respects and welcomes students of all backgrounds, identities, and abilities. If there are circumstances that make our learning environment and activities difficult, if you have medical information that you need to share with me, or if you need specific arrangements in case the building needs to be evacuated, please let me know. I am committed to creating an effective learning environment for all students, but I can only do so if you discuss your needs with me as early as possible. I promise to maintain the confidentiality of these discussions. Any student with a documented disability who requires academic accommodations should contact Services for Students with Disabilities as soon as possible to request an official letter outlining authorized accommodations. For more information, visit http://diversity.utexas.edu/disability/

Counseling and Mental Health Center
Do your best to maintain a healthy lifestyle this semester by eating well, exercising, avoiding drugs and alcohol, getting enough sleep and taking some time to relax. This will help you achieve your goals and cope with stress.

All of us benefit from support during times of struggle. You are not alone. There are many helpful resources available on campus and an important part of the college experience is learning how to ask for help. Asking for support sooner rather than later is often helpful.
If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, we strongly encourage you to seek support.
http://www.cmhc.utexas.edu/individualcounseling.html

The Sanger Learning Center
Did you know that more than one-third of UT undergraduate students use the Sanger Learning Center each year to improve their academic performance? All students are welcome to take advantage of Sanger Center's classes and workshops, private learning specialist appointments, peer academic coaching, and tutoring for more than 70 courses in 15 different subject areas. For more information, please visit http://www.utexas.edu/ugs/slc or call 512-471-3614 (JES A332).

Undergraduate Writing Center: http://uwc.utexas.edu/
Libraries: http://www.lib.utexas.edu/
ITS: http://www.utexas.edu/its/
Student Emergency Services: http://deanofstudents.utexas.edu/emergency/

BeVocal
BeVocal is a university-wide initiative to promote the idea that individual Longhorns have the power to prevent high-risk behavior and harm. At UT Austin all Longhorns have the power to intervene and

reduce harm. To learn more about BeVocal and how you can help to build a culture of care on campus, visit wellnessnetwork.utexas.edu/BeVocal.

Important Safety Information:
If you have concerns about the safety or behavior of fellow students, TAs or Professors, call BCAL (the Behavior Concerns Advice Line): 512-232-5050. Your call can be anonymous. If something doesn't feel right – it probably isn't. Trust your instincts and share your concerns.

The following recommendations regarding emergency evacuation from the Office of Campus Safety and Security, 512-471-5767, http://www.utexas.edu/safety/
Occupants of buildings on The University of Texas at Austin campus are required to evacuate buildings when a fire alarm is activated. Alarm activation or announcement requires exiting and assembling outside.

- Familiarize yourself with all exit doors of each classroom and building you may occupy. Remember that the nearest exit door may not be the one you used when entering the building.
- Students requiring assistance in evacuation shall inform their instructor in writing during the first week of class.
- In the event of an evacuation, follow the instruction of faculty or class instructors. Do not re-enter a building unless given instructions by the following: Austin Fire Department, The University of Texas at Austin Police Department, or Fire Prevention Services office.
- Link to information regarding emergency evacuation routes and emergency procedures can be found at https://preparedness.utexas.edu/safety/emergency-terms

Title IX Reporting
Title IX is a federal law that protects against sex and gender based discrimination, sexual harassment, sexual assault, sexual misconduct, dating/domestic violence and stalking at federally funded educational institutions. UT Austin is committed to fostering a learning and working environment free from discrimination in all its forms. When sexual misconduct occurs in our community, the university can:

1. Intervene to prevent harmful behavior from continuing or escalating.
2. Provide support and remedies to students and employees who have experienced harm or have become involved in a Title IX investigation.
3. Investigate and discipline violations of the university's relevant policies.

Faculty members and certain staff members are considered "Responsible Employees" or "Mandatory Reporters," which means that they are required to report violations of Title IX to the Title IX Coordinator. **I am a Responsible Employee and must report any Title IX related incidents** that are disclosed in writing, discussion, or one-on-one. Before talking with me, or with any faculty or staff member about a Title IX related incident, be sure to ask whether they are a responsible employee. If you want to speak with someone for support or remedies without making an official report to the university, email advocate@austin.utexas.edu For more information about reporting options and resources, visit titleix.utexas.edu or contact the Title IX Office at titleix@austin.utexas.edu.