22.839.510.30: Numerical Analysis
Fall 2020
Mondays 6-9pm, Webex

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COURSE DESCRIPTION

Modeling random variables, approximation of functions by polynomials and piecewise polynomials, numerical integration, and the numerical solution of initial value problems for ordinary differential equations, the numerical solution of linear systems of equations, the approximation of matrix eigenvalues and eigenvectors, the numerical solution of nonlinear systems of equations, numerical techniques for unconstrained function minimization, finite difference and finite element methods for two-point boundary value problems, and finite difference methods for some model problems in partial differential equations

OFFICE HOURS

(Hours and location are subject to change)

Mondays, 12-1pm,
Thursdays, 11am-12pm

There can be additional office hours/review sessions. Check weekly announcements!

COURSE MATERIALS

- **Textbooks**

1. *K. Atkinson,* An Introduction to Numerical Analysis*, Wiley (any edition), 1989.*

2. *P. Brandimarte,* Numerical Methods in Finance and Economics: A MATLAB-Based Introduction, *Second Edition*

Additional reading material may be introduced during the course

- Check the course website on Canvas and your official Rutgers email account regularly

- Software: MATLAB and /or Python will be used to illustrate all concepts and numerical algorithms.
A sizeable part of your coursework will consist in writing MATLAB programs.

PREREQUISITES

Good knowledge of Linear Algebra and Differential/Integral Calculus, some background in Probability and Statistics. Knowledge of Numerical Methods, Differential Equations and some programming skills would be very helpful.

TECHNOLOGY REQUIREMENTS

In response to the COVID-19 crisis, all in-person courses at Rutgers have been transformed into remote instructions courses. This means that all instruction, student-teacher interaction, and assessment of student performance will take place online. Lectures will be delivered live during the scheduled class time. Students will be able to interact and ask questions via chat and breakout rooms during the scheduled meeting times. The lectures will also be recorded for later reference, but students are expected to participate in the live classes (take notes, ask questions and answer questions posed by the instructor).

By signing up for the course, a student consents to have videos of themselves recorded as needed for authentication purposes. We take seriously our obligation to students to provide a level playing field that does not disadvantage our many students of high integrity. Therefore, there will be some form of video control of test environments. This type of online proctoring will require the use of a webcam and a mic. Students will also need, at those times, to be in an environment that affords them privacy, if only to avoid the recording of others who may not be aware of it.

During each class/exam you are expected to be logged in in Webex with your webcam on and your microphone activated.

ACADEMIC CONDUCT

All students are expected to know, understand and live up to the standards of RU Academic Integrity Policy (http://academicintegrity.rutgers.edu/). Don't let cheating destroy your hard-earned opportunity to learn. See business. rutgers.edu/ai for more details.

ATTENDANCE AND PARTICIPATION

There is a strong relationship between attendance/active participation and grades.

Students will be responsible for all work missed during an absence, no matter what the reason for the absence.

GRADING POLICY AND EXAMS

There are following graded items in this course:

- Active class participation;
- Homework;
- Midterm Exam;
- Final Exam.

You will receive a separate score between 0 and 100 for each of the items. The final grade will be a <u>weighted average of these items</u> using the weighting scheme i ndicated below.

- Homework problems will be graded "on completion". They should be solved regularly and kept in an organized way. All coding problems have to be submitted via Assignments on Canvas. All students may be asked to explain their solutions at any time during the semester.

  No late homework will be accepted for any reasons, but the lowest grade will be dropped at the end of the course.

  You can discuss assignment problems with your classmates, however you MUST write the code yourself. In case when instructor suspects that the code was copied, you may be asked to explain in detail what your program does and how it operates. You should also be able to write a code for the same problem from scratch.
  In case when cheating on homework is confirmed, the student will receive a score of 0 for the whole portion of homework grade for the semester, not just for one set.

- The **Midterm Exam** is scheduled for October 27, 2020, during regular class hours. The format of the exam is closed-book. Please only use pencils, pens, erasers, a standard calculators (with the basic functions; not programmable and/or cell phone), and have your Rutgers ID card available with you to the exam. There will be no make-up midterm exam. You will receive a score of zero if you miss the exam.

- The **Final Exam** (cumulative) will be held on **December 8, 2020**, during regular class hours. The format of the exam is closed-book. Please only bring pencils, pens, erasers, a standard calculators (with the basic functions; not programmable and/or cell phone), and your Rutgers ID card with you to the exam. All course materials will be relevant for the final exam. There will be no make-up final exam. You will receive a score of zero if you miss the exam.

  You need to score at least 40% on the Final Exam to pass the course.

- Grading distribution:

Participation in class	...	7%
Homework	...	13%
Midterm Exam	...	35%
Final Exam	...	45%

- There are no opportunities for extra credit except the ones provided in class and regular exams.

- Grade allocation:

Weighted average of graded items	Corresponding grade
$[92, +\infty)$	A
$[90, 92)$	A-
$[84, 90)$	B+
$[76, 84)$	B
$[70, 76)$	B-
$[64, 70)$	C+
$[56, 64)$	C
$[50, 56)$	C-
$[40, 50)$	D
$[0, 40)$	F

- All (partial) scores received throughout the course will be added to the *Gradebook* on the Canvas course website.

- Your partial scores/final grades are not subject to negotiation. If you feel I have made an error, submit your written argument to me within one week of receiving your grade/score. Clarify the precise error I made and provide all supporting documentation. If I have made an error, I will gladly correct it. But I will adjust grades only if I have made an error.

SCHEDULE

The course follows the Rutgers Academic Calendar, which can be found here: `https://scheduling.rutgers.edu/scheduling/academic-calendar`.

SUPPORT SERVICES

- Rutgers University welcomes students with *disabilities* into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: `https://ods.rutgers.edu/students/documentation-guidelines`. If the documentation supports your request for reasonable accommodations, your campuss disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please complete the Registration form on the ODS web site at: `https://ods.rutgers.edu/students/registration-form`. For more information please contact Kate Torres at (973)353-5375 or in the Office of Disability Services in the Paul Robeson Campus Center, in suite 219 or by contacting `odsnewark@rutgers.edu`.

- If you are a *military veteran* or are on active military duty, you can obtain support through the Office of Veteran and Military Programs and Services. `http://veterans.rutgers.edu/`

- If you are in need of *mental health* services, please use our readily available services. Rutgers University-Newark Counseling Center: `http://counseling.newark.rutgers.edu/`

- If you are in need of *physical health* services, please use our readily available services. Rutgers Health Services Newark: `http://health.newark.rutgers.edu/`

- If you are in need of *legal services*, please use our readily available services: `http://rusls.rutgers.edu/`

- If you are in need of additional *academic assistance*, please use our readily available services.
  - Rutgers University-Newark Learning Center: `http://www.ncas.rutgers.edu/rlc`
  - Rutgers University-Newark Writing Center: `http://www.ncas.rutgers.edu/writingcenter`

Attendance policy

The University is committed to a culture of academic engagement between students and faculty. Part of this commitment involves taking responsibility for attending your classes, workshops and exams, and informing your instructors when you cannot attend.

If you are absent from a class or exam for any reason, please **email the instructor.**

All students are expected to bring a positive attitude to the classroom, and to respect the learning environment. This means, at a minimum, that no student will disrupt the learning environment, even in small ways, which includes sending or receiving text messages, or surfing the internet, or tweeting, or talking to other students about anything unrelated to the subject matter at hand. So, **PLEASE NO CELL PHONES, COMPUTERS or OTHER ELECTRONIC DEVICES IN CLASS** unless you are asked to use them.

> **Please notice that office hour time is reserved for students who have attended class; it is not for giving private classes to students who did not attend at the scheduled time, however good their reasons.**
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> I understand that you might have to miss a class or two during the semester. In this case, you are encouraged to obtain class notes from your peers, read the textbook and come to office hours to clarify any topics you have difficulty with. **If you miss three or more classes, the instructor reserves a right to lower your course grade by one letter grade (that is, an A will become a B, a B+ will become a C+, etc).**
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> **Late arrivals and departures are considered as a missed class.**

Participation

You are expected to actively participate in the course. This participation can consist of in-class discussions or visits to office hours.

The most active participants (those who ask relevant questions and provide good answers) will get a bonus at the end of the course.

Time commitment

This is a challenging course.

Mastering the material of this course requires time. Successful students in the past reported that they consistently spent at least 7 hours per week to review the material and solve problems, and more than that before major exams.

... There have been many studies of elite performers – concert violinists, chess grand masters, professional ice-skaters, mathematicians, and so forth – and the biggest difference researchers find between them and lesser performers is the amount of deliberate practice they've accumulated. Indeed, the most important talent may be the talent for practice itself.

Gawande A., "The Learning Curve", *The New Yorker*, January 28, 2002, p.52-61.

If you are just looking to fill a slot in your schedule or looking for a "light elective", you should not be taking this course.

I want you to do well in this class. Your approach should be learning concepts thoroughly and practising with a variety of problems. You are warmly invited to ask questions in class and in office hours. Feel free to let me know if you have any problems with the class and express your concerns during the semester. Your feedback is always welcome!

CAUTION: The information in this syllabus is subject to change, as announced in class or via email/Canvas. No major changes are anticipated, but you are expected to attend class and check email regularly.