

Numerical Methods (MATH 504)

Fall 2022

Class Meetings: Tuesdays 6:30 pm - 9:00 pm in STM 126

Course Website: <http://canvas.georgetown.edu/>

Instructor: Dr. Maryam Yashtini

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Office: 311 Saint Mary's Hall

Office Hours: T 5:30 pm- 6:20 pm, or by appointment

Description. Prerequisite: MATH 502 & MATH 510. This course introduces numerical methodologies for solving system of linear and nonlinear equations, nonlinear equations; approximation and interpolation; numerical integration and least squares methods. Some applications in data analysis and image processing will be discussed. Some knowledge in one computer programming language is required.

Textbook. Textbook is not required. The slide presentation of lectures will be available on Canvas right after each class. But the following textbooks will be used for this course:

- Numerical Analysis by T Sauer, 2nd Edition, Pearson, 2011.
- Numerical Methods and Optimization and Introduction, Butenko and Pardalos, 2014.

Lectures. Some topics that will be covered in the course are summarized below: Basic concepts: vectors, matrices, and norms; direct methods for solving systems of linear equations; iterative methods for solving systems of linear equations; overdetermined Systems and least squares solution and linear regression; stability, condition number, Big O and little o ; eigenvalues/eigenvectors, power method, page rank; matrix decomposition; solving nonlinear systems of equations; gradient vector, convex and nonconvex functions; steepest descent and backtracking, Newton's method; interpolation: polynomial, spline, spline regression; constrained optimization, Lagrange Theorem, KKT point (if time permits);

Homework. Weekly homework will be posted regularly throughout the semester.

- Grading: 50% of each homework grade is for completion, and one problem will be selected to grade for accuracy.
- Homework policy: you are encouraged to discuss homework questions with classmates or your instructor. However, copying others' solutions or programs is considered a serious violation, which will be immediately reported. You should never share your written solutions with anyone else. Posting solutions online is also a serious violation.
- You are required to use LaTeX editor to type your solutions, otherwise a few points will be deducted. Grading will take both correctness and clarity into consideration. Assignments should be submitted on Canvas as a SINGLE PDF document.
- Late submission: for each day of late submission, two points will be deducted. *The lowest homework grade will be dropped.*
- Some homework might include problems that require programming and can be completed in Python or Matlab language. You need to copy and paste the code and its results into the document. If you're using LaTeX, you may use the *verbatim* package.
- Every homework set will have the equal weight.

Course grade. The course grade will be based on homework (50%), three mid-semester exams (10% each), and a final assignment (20%). The following scale is used to relate percentage or point score to letter grades.

	100-94: A	93-91: A–
90-86: B+	85-81: B	80-76: B–
75-71: C+	70-66: C	65-61: C–
60-56: D+	55-50: D	below 50: F

Course Calendar–Fall 2022–MATH 504

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Week 1	Aug 22th	23th	24th	25th	26th
Week 2	29th	30th Lecture 1	31th	Sep 1st	2nd
Week 3	5th Labor Day	6th *Mon. schedule	7th	8th	9th
Week 4	12th	13th Lecture 2	14th	15th	16th
Week 5	19th	20th Lecture 3	21st	22nd	23rd
Week 6	26th	27th Lecture 4+Ex1	28th	29th	30th
Week 7	Oct 3rd Columbus Day	4th Lecture 5	5th	6th	7th
Week 8	10th	11th Lecture 6	12th	13th	14th
Week 9	17th	18th Lecture 7	19th	20th	21th
Week 10	24th	25th Lecture 8+Ex2	26th	27th	28th
Week 11	31st	Nov 1st Lecture 9	2nd	3rd	4th
Week 12	7th	8th Lecture 10	9th	10th	11th
Week 13	14th	15th Lecture 11	16th	17th	18th
Week 14	21st	22nd Lecture 12+Ex3	23rd Fall Recess Begins	24th Thanksgiving Day	25th No class
Week 15	28th	29th Lecture 13	30th	Dec 1st	2nd
Week 16	5th	6th Lecture 14	7th	8th	9th

- Exam 1, 2, and 3 will be respectively on the following dates: Sep 27th, Oct 25th, Nov 22nd.
- Homework will be assigned after the class, and are due on the midnight of the upcoming class. For example, Homework 2 will be posted on Sep 13th and will be due 11:59 pm on Sep 20th.