Math, SUSTech
MA305 Numerical Analysis
Fall 2025, Syllabus

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1 General Information

1.1 Class time/location

Time: Thur. 14:00-15:50 each week; Tue. 14:00-15:50 each odd week.
Location: R. 206 Business School Building.

1.2 Office Hours

Wed., 09:30AM-11:30AM, M710, College of Science Bldg, or make an appointment for other time.

1.3 Textbook

Numerical Analysis, **10th Edition** (source for homework),by Burden, Faires,Burden.

2 Course Structure

2.1 Assignments (24%)

Homework will be assigned every lecture. All questions are selected from the textbook which will be written in the lecture notes. But only homeworks assigned in the odd weeks should be handed in. Homework will be collected each even week (**Thursday in class**) 8 times in total. **No late assignments will be accepted.** Homework will be accounted for 24% of the credit. Homework must be readable and must be stapled.

2.2 Quizzes (20%)

You will have short quizzes class, 5 times in total. It usually takes 20-30 minutes, which requires you to understand concepts and basic problem solving skills. **No makeups will be made for quizzes**. Only best 4 scores are accounted for credit.

2.3 Midterm (20%)

One midterm is planned on the **9th Saturday evening, tentatively**. If you miss the Midterm, **no makeups will be made for the midterm**. Only for extraordinary cases with documented reasons, your score will be the same as the final exam, in which case your final score takes up 56% credit.

2.4 Final Exam (36%)

3 Tentative Course Outline

Chapter 1. Mathematical Preliminaries and Error Analysis
- 1.2 Round-off Errors and Computer Arithmetic

Chapter 2. Solutions of Equations in One Variable
- 2.1 The Bisection Method
- 2.2 Fixed-Point Iteration
- 2.3 Newton's Method and Its Extensions
- 2.4 Error Analysis for Iterative Methods

2.5 Accelerating Convergence**
Chapter 3. Interpolation and Polynomial Approximation
3.1 Interpolation and the Lagrange Polynomial
3.2 Data Approximation and Neville's Method
3.3 Divided Differences
3.5 Cubic Spline Interpolation
Chapter 4. Numerical Differentiation and Integration
4.1 Numerical Differentiation
4.3 Elements of Numerical Integration
4.4 Composite Numerical Integration
4.6 Adaptive Quadrature Methods**
4.7 Gaussian Quadrature
Chapter 5. Initial-Value Problems for Ordinary Differential Equations
5.1 The Elementary Theory of Initial-Value Problems
5.2 Euler's Method
5.4 Runge-Kutta Methods
5.6 Multistep Methods*
5.9 Higher-Order Equations and Systems of Differential Equations
5.10 Stability
Chapter 6. Direct Methods for Solving Linear Systems
6.1 Linear Systems of Equations
6.2 Pivoting Strategies
6.3 Linear Algebra and Matrix Inversion
6.4 The Determinant of a Matrix
6.5 Matrix Factorization
6.6 Special Types of Matrices
Chapter 7. IterativeTechniques in Matrix Algebra
7.1 Norms of Vectors and Matrices
7.2 Eigenvalues and Eigenvectors
7.3 The Jacobi and Gauss-Siedel Iterative Techniques
7.6 The Conjugate Gradient Method**
Chapter 10. Numerical Solutions of Nonlinear Systems of Equations
10.1 Fixed Points for Functions of Several Variables
10.2 Newton's Method
10.4 Steepest Descent Techniques*
Chapter 9. Approximating Eigenvalues
9.1 Linear Algebra and Eigenvalues
9.2 Orthogonal Matrices and Similarity Transformations
9.3 The Power Method, Inverse iteration and Rayleigh Quotient Iteration
9.4 Householder's Method
9.5 The QR Algorithm
9.6 Singular Value Decomposition
Chapter 8. ApproximationTheory
8.1 Discrete Least Squares Approximation
8.2 Orthogonal Polynomials and Least Squares Approximation
8.3 Chebyshev Polynomials
8.5 Trigonometric Polynomial Approximation
8.6 Fast Fourier Transforms**

*: **covered in class if time allowed, not required in any tests.**
: **not covered in class, but highly recommended to learn by yourself.