Math3312: Numerical Analysis, Fall 2023

Instructor

Mo Mu

Contact Details: Office Hour: Tuesday 11:00 -- 11:50 AM, Room 3445; e-mail: mamu@ust.hk

Teaching Time & Venue

TT, 12:00 - 13:20, Room 2502

TA

PU, Zhigang/zpuac, starting Week 2

Assessment Scheme

Homework: 10%; ***Midterm Exam****:* 30 %; ***Final Exam****:* 60 %

Final grades are determined based on the University Grading Guidelines, for details, refer to

https://registry.hkust.edu.hk/files/2021-05/GuidelinesOnGrading.pdf

Exams:

1. ***Midterm exam:*** Topics to be covered: up to Chap 3

   Oct 26, Week 8, in class, 12:00-13:20, Room 2502

If you *miss the midterm* due to a valid (e.g. hospitalization) and well proven reason (original documents must be submitted for verification), the only alternative is to move the midterm mark to the final.

2. ***Final exam:***120 minutes. All materials taught in the whole semester will be tested, including those already tested in the midterm exam. But focus will be on those topics not covered in the midterm exam.
3. **Closed-book**

Course Description

Credit Points: 3

Pre-requisite: COMP 1002/COMP 1004 and MATH 2121/MATH 2111/MATH 2350/MATH 2131; and MATH 2033/MATH 2031/MATH 2043

Exclusion: MATH 3311

Brief Information/synopsis:

This course presents numerical methods for solving mathematical problems. It deals with the theory and application of numerical approximation techniques as well as their computer implementation. It covers computer arithmetic, solution of nonlinear equations, interpolation and approximation, numerical integration and differentiation, solution of differential equations, and matrix computation.

Student Learning Resources

Textbook:

Numerical Analysis (10^{th} Ed), by Burden, R.L. and Faires J. D., Thomson Brooks/Cole.

References:

Math Support Center

Course Topics:

Preliminaries

- Roundoff Errors and Computer Arithmetic, Significant digits (1.2)
- Programming with Numerical Methods (e.g. Matlab)

Root Finding (Chapter 2)

- Bisection method (2.1)
- Fixed-point theory; Fixed-point iteration (2.2)
- Newton's method; Secant method (2.3)

Interpolation (Chapter 3)

- Interpolation and the Lagrange (interpolating) polynomial; the approximation error (3.1)
- Divided differences and Newton's interpolatory divided-difference formula (3.3)

Numerical Differentiation and Integration (Chapter 4)

- Numerical differentiation--forward, backward; central finite differences and errors (4.1)
- Elements of numerical integration (4.3)
- Composite rules (4.4)

Solution of Ordinary Differential Equations (Chapter 5)

- Euler's method; the approximation error (5.2)

Solving Linear Systems (Chapters 6 & 7)

- Gauss elimination--multipliers, Gauss elimination, back substitution; partial pivoting (6.1 - 6.2)

- LU factorization--LU, forward substitution (6.5)
- Iterative methods--matrix splitting, Jacobi method; Gauss-Seidel method; SOR method (7.3-7.4)