

Numerical Methods (first half)

To prepare for the final exam you should

- study all definitions, theorems, and examples given in class,
- study all graded homework problems that are related to the relevant topics from below.

The exam will not include long proofs or more specific details of some longer theorems. However, you need to be able to use the methodology and know the formulas and understand the general ideas of the theorems as well as the more applied theorems.

In the exam, only pen, blank paper, and a simple calculator are allowed. That means that no notes, no cheat sheet, no books are allowed.

Relevant topics are:

- Taylor series and Taylor theorem, error terms and asymptotic errors
- Number representation (just concepts, no formulas)

Systems of linear equations $Ax=b$

- Gaussian elimination with and w/o pivoting, scaled partial pivoting
- LU decomposition
- Cholesky decomposition

(Systems of) Non-linear equations

- Methods for root finding and their errors:
Bisection method, Newton's method, Secant method
- Type and order of convergence

Interpolation and approximation of overdetermined systems

- Polynomial interpolation, collocation matrix
- Lagrange interpolation
- Newton interpolation
- Piecewise interpolation (just concept)
- Spline interpolation, B-splines (just concept, no formulas)
- Least squares approximation

Approximation of derivatives

- Difference quotients (forward, backward, central)
- Richardson extrapolation

Approximation of integrals

- Lower- and upper Riemann sum
- Trapezoidal rule for integration
- Romberg algorithm

Clearly, you must also be proficient in all prerequisites from Calculus and Linear Algebra that are associated to the above mentioned topics.