

METU NCC
MECHANICAL ENGINEERING DEPARTMENT
MECH 310 – Numerical Methods

Course outline

1. Mathematical modeling of engineering problems: aim of the course, some concepts in approximations. The errors due to chopping, rounding, truncation. **(3 hrs)**
2. Solution of nonlinear equations: graphical method, bracketing methods (bisection and false-position methods); open methods (simple fixed-point iteration, Newton-Raphson and secant methods). **(8 hrs)**
3. System of nonlinear equations (simple fixed-point iterations, Newton's method). **(3 hrs)**
4. Linear system of equations: direct methods (Gauss elimination methods, LU decomposition method, ill-conditioned systems and pivoting strategies), indirect methods: (Jacobi and Gauss Seidel methods), Eigenvalue and eigenvectors; power method. **(8 hrs)**
5. Approximation of functions: Least-squares regression, interpolation (Newton and Lagrange interpolating polynomials) **(8 hrs)**
6. Numerical differentiation and numerical integration (trapezoidal and Simpson's rules and Gauss quadrature). **(4 hrs)**
7. Numerical solution of ordinary differential equations: initial value problems (Taylor, Euler and Runge-Kutta methods), boundary value problems (shooting and finite difference methods). **(8 hrs)**

Textbook:

- Chapra, S. C. and Canale, R. P., Numerical Methods for Engineers, 7th Edition, McGraw-Hill, 2014.

References

- Burden, R. L. & Faires J. D., Numerical methods, Brooks/Cole, 2012.
- Cheney, W. & Kincaid, D., Numerical mathematics and computing, Brooks-Cole, 2013.
- Mathews, J.H. & Fink, K. D., Numerical methods using MATLAB, Pearson 2004.
- Yang, W. Y., Applied numerical methods using MATLAB, Wiley-Interscience, 2005.

| | | |
|------------------------|----------------------------------|-----|
| Grading Policy: | Midterm Exam + Assignment + Quiz | %65 |
| | Final Exam | %35 |

Please note that:

- Attendance is considered as cooperation with the instructor in the learning process.
- Students are expected to use MATLAB to solve assigned problems.