ES 361 – Computing Methods in Engineering

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. Solution of 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). **(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., Applied numerical methods with MATLAB for engineers and scientists, McGraw-Hill, 2012. (**On reserve : QA297 .C4185 2012**)

References

➢ Burden, R. L. & Faires J. D., Numerical methods, Brooks/Cole, 2012. (**On reserve : QA297 .F35 2012**)

➢ Cheney, W. & Kincaid, D., Numerical mathematics and computing, Brooks-Cole, 2013. (**On reserve : QA297 .C426 2013**)

➢ Mathews, J.H. & Fink, K. D., Numerical methods using MATLAB, Pearson 2004. (**On reserve : QA297 . M39 2004**)

➢ Yang, W. Y., Applied numerical methods using MATLAB, Wiley-Interscience, 2005. (**On reserve : QA297 .A685 2005**)

Grading Policy: Midterms + Homework   %65
Final   %35

Please note that:

➢ Attendance is considered as cooperation with the instructor in the learning process. An NA grade is given, if regular attendance is not maintained.

➢ If a student misses any of the exams and has a valid excuse, then a makeup exam will be given after the finals.