MATH 3350.001: Introduction to Numerical Analysis

TIME AND PLACE: Wh 213, TIME: MoWeFr 9:00 - 9:50am
PROFESSOR: Santiago I. Betelú
OFFICE: Wh 213, e-mail: santiago.betelu@unt.edu
TEXT: Timothy Sauer "Numerical Analysis" Third edition
OFFICE HOURS: GAB 470B MoWeFr 8-8:50am and 9:50-11:55am

COURSE DESCRIPTION: Description and mathematical analysis of methods used for solving problems of a mathematical nature on the computer. Roots of equations, systems of linear equations, polynomial interpolation and approximation, numerical solutions of differential equations.

GRADES: Grades will be based on three midterm exams (20 points each), homeworks and quizes (20 points) and a final exam (40 points). The lowest of the midterm grades is dropped, so the maximum score is 100. To earn an A you need 90 points, 80 for a B, 70 for a C and 60 for a D.

HOMEWORK: Will be assigned in Canvas and your solutions must be uploaded within the indicated deadline. Check your solutions with the solutions at the end of the textbook, if you don't get them come to my office for help. The grader evaluates the intermediate steps so you must be clear to get the full grade. Some HW problems are computer assignments, I will ask you to show them to me running in your computer or smartphone during office hours.

EXAMS: Midterm exams will be given on Sep 22, Oct 27 and Dec 1 on regularly scheduled class time. The final exam is scheduled on Wed Dec 13 at 8:00-10:00 AM on the same classroom (these dates may change, so ask me one week before).

PROGRAMMING: We will do elementary programming in Matlab using the website https://matlab.mathworks.com, accesible by computer, tablet or smartphone. You need to register for online access at https://it.unt.edu/matlab-simulink (click "Mathworks portal" and authenticate with EUID and password). Previous programming experience is not necessary, I will teach the basics during the first few classes, and we shall use only a minimal subset of MATLAB's functions.

DISSABILITIES: It is responsibility of students with certified disabilities to provide the instructor with appropriate documentation from the Dean of Students Office. If you qualify for extra time you must take the exam at the ODA Test Center.

CHEATING: or homework plagiarism will not be tolerated. Anyone caught cheating will receive an F for the course. Notes, calculators or electronic devices are not allowed during exams.

SCHEDULE

Week	Sections	Summary
Aug 21	0.2 - 0.5	Binary numbers, floating point representation and loss of significance. Introduction to MATLAB. Taylor theorem. Applications: numerical differentiation.
Aug 28	1.1 - 1.3	Solving equations, Bisection method, fixed point iteration, solving linear recursions, limits of accuracy
Sep 4	1.4 - 1.5, 2.1	Newton's method, error analysis, secant method, Brent's method, Gaussian elimination, tridiagonal systems
Sep 11	2.3, 2.5, 2.7	Iterative methods for systems of equations, nonlinear systems of equations, MT1
Sep 18	3.1 - 3.3	Lagrange interpolation, interpolation errors, Chebyshev interpolation
Sep 25	4.1, 4.2, 5.1, 5.2	Least squares and models. Numerical differentiation, numerical integration
Oct 2	5.3, 5.4, 5.5	Romberg integration, adaptive quadrature, Gaussian quadrature
Oct 9	6.1, 6.2, 6.3	Initial value problems, error analysis, systems of ODES
Oct 16	6.4, 6.5 6.6, 6.7	Runge Kutta, variable step size, implicit methods, stiff equations, multistep methods, stability, convergence and consistency, MT2
Oct 23	7.1, 7.2	Boundary value problems. Shooting method, finite differences, applications
Oct 30	8.1	PDES: parabolic methods, Von Neumann stability
Nov 6	8.2	Hyperbolic equations, waves, CFL condition, stability, error analysis
Nov 13	8.3	Elliptic equations, Laplace equation, Poisson equation. Applications. MT3
Nov 20	8.4	Nonlinear PDEs, reaction-diffusion problems, biological problems, fluid flow.
Nov 27	9.1, 9.2	Random numbers, Pseudo random numbers generation, and Monte Carlo Simulation.
Dec 4		Comprehensive review
Dec 13		Final Exam Wed 8:00-10:00am