MATH 3350.001: Introduction to Numerical Analysis

TIME AND PLACE: MoWeFr 9:00-9:50AM, Wh 214
PROFESSOR: Santiago I. Betelú
OFFICE: GAB470B, e-mail: santiago.betelu@unt.edu
TEXT: Timothy Sauer "Numerical Analysis" Third edition
OFFICE HOURS: MoWeFr 7:55-8:55AM, 10:00-11:00AM and MoWe 16:25-17:25PM

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

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 26, Oct 24 and Nov 21 during regularly scheduled class time. The final exam is scheduled on Wed Dec 10 at 8:00-10:00AM 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 18	0.2 - 0.5	Binary numbers, floating point representation and loss of significance. Introduction to MATLAB. Taylor theorem. Applications: numerical differentiation.
Aug 25	1.1 - 1.3	Solving equations, Bisection method, fixed point iteration, solving linear recursions, limits of accuracy
Sep 1	1.4 - 1.5, 2.1	Newton's method, error analysis, secant method, regula falsi, Gaussian elimination, tridiagonal systems
Sep 8	2.3, 2.5, 2.7	Iterative methods for systems of equations, nonlinear systems of equations
Sep 15	3.1 - 3.3	Lagrange interpolation, interpolation errors, Chebyshev interpolation
Sep 22	4.1, 4.2, 4.4, 4.5	Least squares and models. Numerical differentiation, numerical integration
Sep 29	5.1, 5.2	Romberg integration, adaptive quadrature, Gaussian quadrature
Oct 8	5.3, 5.4, 5.5	Initial value problems, error analysis, systems of ODES
Oct 13	6.1, 6.2, 6.3	Runge Kutta, variable step size, implicit methods, stiff equations, multistep methods, stability, convergence and consistency
Oct 20	6.4, 6.5 6.6, 6.7	Boundary value problems. Shooting method, finite differences, applications
Oct 27	7.2, 7.2	Discretization of PDEs: parabolic methods, Von Neumann stability
Nov 3	8.1	Hyperbolic equations, waves, CFL condition, stability, error analysis
Nov 10	8.2	Elliptic equations, Laplace equation, Poisson equation. Applications.
Nov 17	8.3	Nonlinear PDEs, reaction-diffusion problems, biological problems, fluid flow
Nov 24	8.4	Random numbers, Pseudo random numbers generation, and Monte Carlo Simulation. Comprehensive review
Dec 1		Comprehensive review
Dec 10		Final Exam Wed Dec 10, 8:00-10:00AM