

(—; 3-1-0)

## Application of Numerical Methods

MATH-272\*

An introductory course on the effective use of computers in science and engineering. Topics include: solving linear and nonlinear equations, interpolation, numerical integration and numerical solution of ordinary differential equations. For each case, considerable analysis of errors is included. Students are expected to write simple programs that invoke standard numerical routines as well as combining tools to solve more complex application problems. Extensive use is made of MATLAB, a high level interactive numerical package that permits students to quickly increase their understanding of the numerical methods.

**Textbook:** *Numerical Methods with MATLAB*, 1st Edition  
by G. Recktenwald (Prentice Hall)

**Prerequisite:** First year courses in calculus *and* linear algebra.  
Some previous computing experience.

**Corequisite:** A course in ordinary differential equations *or*  
permission of the instructor.

**Instructor:** A. Ableson

<b>Evaluation:</b>	Final Examination	50%
	Midterm Test	20%
	6 Assignments (5% each)	30%

**Outline:**

1. Introduction: number representation, floating point arithmetic, order calculations
2. Linear equations: Gaussian elimination, conditioning, LU decomposition
3. Scalar non-linear algebraic equations: Bisection, Secant, Newton Raphson, convergence
4. Interpolation: polynomial, splines, hermitian polynomials
5. Quadrature: Newton Cotes, error estimation
6. Initial value problems: Euler, Runge-Kutta
7. Optimization (simulated annealing, simplex, conjugate gradient)