PHYS: INTRODUCTORY COMPUTATIONAL PHYSICS SPRING 2020
UNIQUE # 55015 TTH 2:00-3:30 PM, RLM 7.104

Instructor: Prof. James Chelikowsky, jrc@utexas.edu, 512-232-9083, POB 4.324
Office Hours: Tuesdays and Thursdays 3:30-4:30 pm.

Teaching assistant: Alex Leviyev, email: alexleviyev@utexas.edu. Office hours and location TBA.

Text (not required): Steven G. Chapra, "Applied Numerical methods with *MATLAB* for Engineers and Scientists", 3rd edition or 4th edition, McGraw-Hill.

Other useful books:

J.R. Chelikowsky, "Introductory Quantum Mechanics with MATLAB: For Atoms, Molecules, Clusters, and Nanocrystals," 1st Edition, Wiley, 2019.
P. Harrison, "Computational methods in physics, chemistry and biology," Wiley, 2001.
R. H. Landau and M.J. Pàez, "Computational Physics," Wiley, 2nd Ed. 2007.
M.P. Allen and D.J. Tildesley, "Computer simulation of liquids," Clarendon Press, 1992.
A. Gilat, and V. Subramanian, "Numerical Methods for Engineers and Scientists," Wiley 2007.
D. M. Smith, "Engineering Computation with MATLAB," Pearson Education, 2008.
W. H. Press, S.A. Teuklosky, W.T.Vetterling, B.P. Flannery, "Numerical Recipes in Fortran 77," 2nd edition, Cambridge University Press, 1992.
W. H. Press, S.A. Teuklosky, W.T.Vetterling, B.P. Flannery, "Numerical Recipes in Fortran 90," 2nd edition, Cambridge University Press, 1996.

Website: https://tesla.oden.utexas.edu/phy_329
Lecture notes, homework problems/solutions, exam solutions and other material will be posted on the website. Username and password provided in class.

Overview: Computational methods for problem solving and research in physics; numerical analysis and computer simulation methods for physics applications. Three lecture hours a week for one semester. Only one of the following may be counted: Computer Science 367, Mathematics 368K, Physics 329. We will use MatLab for programming exercise.

Prerequisite: The following coursework with a grade of at least C- in each: Physics 315 and 115L; a programming course at the level of Computer Science 303E with a grade of at least C- or consent of instructor; and credit with a grade of at least C- or registration for Mathematics 341 or 340L.

Grading: Course grades will be determined as follows: Homework 15%. Two midterm exams 25% each. Final exam 35%.
Exam 1, February 27. Exam 2 April 9. The dates are TENTATIVE. Final, TBA.

There will be a total of approximately 10 homework assignments. The assignments and solutions will be posted on our web site. *Solutions should be uploaded on Canvas*. One miss will be permitted. No late homework will be accepted.

Exam policy: There is normally no make-up offered for any exams. Legitimately missed exam scores will be taken by rescaling the final exam. Request for a re-grade must be made in writing within two weeks of the exam in question.

Special Accommodations: The University of Austin provides upon request appropriate academic accommodations for qualified students with disabilities. For more information, check out the site: https://diversity.utexas.edu/disability/

Week of	
January 20	Introduction to computation and Matlab
January 27	Matlab review. Finding roots in nonlinear equations.
February 3	Solution of a single nonlinear algebraic equation by bracketing methods (Bisection).
February 10	Solution of a single nonlinear algebraic equation by open methods (Newton Raphson, Secant methods).
February 17	Matrices: Their representation, special matrices, algebra of matrices.
February 24	Solution of sets of linear algebraic equations by Gaussian Elimination with and without pivoting. **Midterm exam #1**
March 2	Matrix inversion. The eigenvalue problem.
March 9	Solution of multiple sets of nonlinear equations by generalized Newton method
March 16	**Spring Break**
March 23	Finite difference techniques for numerical differentiation. Numerical integration including Monte Carlo methods
March 30	Numerical Methods for Ordinary Differential Equations
April 6	Explicit and implicit methods for solution of initial value problem. **Midterm exam #2**
April 13	Predictor-Corrector methods for solution of initial value problem
April 20	Methods for boundary value problems.
April 27	Curve fitting and interpolation
May 4	Splines