Course: **Math/CS 243A Advanced Numerical Analysis, Fall 2012**

Days and Times: Tu Th 5:30-6:45 in MH 234

Instructor: Plamen Koev

Office: MH 312, **Telephone**: 924-5175, **email**: "last name"@math.sjsu.edu **web**: math.sjsu.edu/~koev

Office hours: T Th 3:30-5pm

Prerequisite: One semester of undergraduate numerical analysis such as our Math / CS 143M (M stands for Matrices) or Math / CS 143C (C stands for Calculus). Also linear algebra, Calculus III and a programming course are prerequisites. Courses that are nice to have but not essential (we will discuss any results needed from these courses): partial differential equations, additional programming, related application courses in physics, chemistry, meteorology, etc.

Text: Numerical Solution of Partial Differential Equations: Finite Difference Methods by G. D. Smith, Third Edition, Oxford Press, 1986

Learning Objectives: To learn tools and techniques to analyze PDEs related to science and engineering including: types of PDEs. finite-difference methods applied to parabolic, elliptic and hyperbolic equations; explicit and implicit schemes; multi-level schemes; convergence and stability; error control; theory of characteristics; semi-discrete approximations; iterative methods of solution (including conjugate gradients) and acceleration techniques; matrix and eigensystem analysis; direct methods for sparse systems; perturbation of matrices; applications to heat flow and computational aerodynamics; shock waves in traffic and fluid flow, electrical potential, and structural mechanics.

Computing in the course: We will augment the material in the text with numerical examples. You will find it convenient to use MATLAB for some of the computer work. Octave if a free alternative. No programming experience is expected. The programming exercises will focus on the numerical aspects, not the coding. The coding will not use anything more complicated than formulas, loops, and if-then statements.

Math 110L: I encourage you to enroll in Math 110L in order to have access to Matlab 7 (and Maple 14) in the department lab. This costs you nothing if you are a regularly enrolled student.

Exams: A midterm on October 16th (30%), a Final (40%) and Homework (30%).

Grading: The curve is: 90/80/70/60 for A/B/C/D.

Approximate Course Schedule:
Parabolic PDEs: 7 weeks, Hyperbolic PDEs 4 weeks, Elliptical PDEs: 4 weeks

Cheating: Don't. Collaborating on homework assignments is OK, but you must turn in your own write-ups.

Additional information / requirements : see http://www.sjsu.edu/math/courses/greensheet

Other textbooks: (in a rough order of increasing difficulty): Finite Difference Methods for Ordinary and Partial Differential Equations by Randall J. LeVeque; Numerical solution of partial differential equations: an introduction by K. W. Morton and D. F. Mayers; Numerical Methods for Partial Differential Equations by G. Evans, J. Blackledge and P. Yardley; The finite difference method in partial differential equations by A. R. Mitchell and D. F. Griffiths; Digital Computer Treatment of Partial Differential Equations by V. Vermuri and Walter J. Karplus; Numerical Methods for Partial Differential Equations by William F. Ames; Numerical Solution of Partial Differential Equations in Science and Engineering by Leon Lapidus and George F. Pinder; Finite Difference Schemes and Partial Differential Equations by John C. Strikwerda. An internet site with some reference material http://www.amath.washington.edu/~rjl/booksnotes.html . We may also cover some material from Computer Solution of Sparse Positive Definite Systems by Alan George and Joseph Liu and Direct Methods for Sparse Linear Systems by Timothy Davis.