ASU College of Liberal Arts & Sciences
ARIZONA STATE UNIVERSITY

Department of Mathematics and Statistics

COURSE ANNOUNCEMENT

FALL 2008

Mathematics MAT 533
Computational Elliptic and Parabolic Partial Differential Equations

Instructor: **Prof. Carl Gardner (gardner@math.asu.edu)**
Time: **9:40 – 10:30 Monday, Wednesday, Friday**
Location: **Durham Lang & Lit 114**
Line Number: **75951**
Credits: **3**

Course Description: This course will survey modern numerical methods for computing solutions to elliptic & parabolic partial differential equations. We will mainly focus on finite difference methods, but some discussion will be given of spectral & finite element methods as well. Solution methods for nonlinear PDEs will be emphasized.
Major applications will include:

- heat (diffusion) equation
  forward & backward Euler, TR, & TRBDF2 methods
  spectral methods
- semiconductor process simulation (nonlinear diffusion)
  TRBDF2 method
- Poisson's equation (electrostatics)
  direct solvers; Jacobi, Gauss-Seidel, SOR, & PCG iterative methods
- nonlinear advection-diffusion
  Burgers' equation, ion flow through the cellular membrane
- semiconductor device equations (hydrodynamic model)
  upwind, Lax-Wendroff, WENO methods
- Navier-Stokes equations (incompressible fluid dynamics)
  Chorin projection method

Course Requirements/Prerequisites: Knowledge of a modern programming language & some experience with PDEs will be helpful. There will be 6 problem sets consisting of problems, computations, & graphics. (No tests or exam.)

Textbook: The text will be Randy LeVeque's *Finite Difference Methods for Ordinary and Partial Differential Equations.*