Math 582C – Topics in Numerical Analysis
Fall 2003
Monday and Wednesday, 17:30-18:45, JR217

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Motivation: Computation has become one of the three legs of science and engineering: Theory, Experiment, and Computation. No discipline has escaped the influence of computation and many disciplines have been reinvented because of new computational capabilities. Today's fastest computers perform over 4 trillion multiplications per second. Good mathematical algorithms are essential to effectively harness this power. This class is the first step in understanding the mathematics of computation.

Course Description: This course treats basic theory of linear partial differential equations (PDE's) together with the most common methods for their numerical solution. It integrates the mathematical analysis of PDE's with the theory of finite difference and finite element methods. Important concepts of modern numerical analysis are illustrated with the simplest type of equations: elliptic, parabolic and hyperbolic. This course is suitable for beginning graduate students of applied mathematics an engineering.

Textbook: **No text book is required**. However, the following books are suggested for reading.

- Numerical methods for differential equations, by Michael A. Celia and William G. Gray, Prentice Hall, (1992).
- Partial differential equations with numerical methods, By Stig Larson and Vidar Thomée, Springer (2003).
- Introduction to partial differential equations with Matlab, by Jeffrey M. Cooper, Birkhäser (1998).
- Numerical methods for partial differential equations, Third edition, by William F. Ames, Academic PRESS (1992).

Topics Covered: This course will be based on the following four cornerstones

- Introduction to PDE's and applications (Classifications, Physical models, analytical solution such as on Fourier series, Fourier transform and Laplace transform)
- Examples of finite difference approximations with error analysis
- Finite difference approximations with error analysis

Exams: There will be three in-class tests and a comprehensive Exam.

All exams are closed book. The lowest midterm score will be dropped. There will be no make up exams.

Homework: Homeworks are due as specified in the HW assignment list. You can work in groups, but you must turn in your own write-up. Your lowest two homework scores will be dropped. No late homework is accepted.

Quizzes: Quizzes may be introduced to help the class to keep-up.

Programming: There will be one programming assignement. You can use your prefered programming language. You can work in groups, but you must turn in your own write-up. Your lowest programming assignement score will be dropped.

Grading Scheme: 100 points – homeworks + quizzes

50 points – each programming assignement

100 points – each midterm

200 points – Final exam

600 points – Total Score