

MATH 414 SYLLABUS Modern Applied Mathematics II – Prof. Sachs– Spring 2007

TEXT: Introduction to Applied Mathematics by G. Strang (Cambridge-Wellesley Press).

COURSE OVERVIEW: The main goals of this course are to introduce the basic ideas of applied mathematics, including the creation of models, the analysis of models, use of numerical simulation, and refinement of models based on the previous parts. Depending on student interest, we will consider some particular applications. Applications are numerous and growing, and include data compression, voice recognition, image processing, internet routing and web streaming, financial analysis, the human genome project, encryption, along with more traditional areas of physics, engineering, chemistry, and computational tools. Students will work individually or in groups and present results of projects along with traditional homework and exams. Outside speakers may introduce current work.

MEETING: Monday and Wednesday, 3:00-4:15pm, Sci. & Tech. I, rm 242.

OFFICE HOURS: Mon. and Wed., 4:30-5:45pm, Sci. & Tech I, rm 201D, and by appt.

CONTACT INFO: OFFICE PHONE: 993-1464 E-MAIL: rsachs@gmu.edu

COURSE WEB PAGE: math.gmu.edu/ rsachs/math414

GRADING: Grading will be fair and impartial. Points used as the basis of the grade will be: Hmwk. (100 pts.); projects (100 pts.); Exams (200 pts.); Final exam (150 pts.).

POLICIES: The GMU Honor code is in effect at all times and students are expected to be fully aware of its requirements. Group work may be part of the course, in which case group members will truthfully report on non-contributing members. Absence from quizzes and exams must be for a valid reason and requires prior notification except in extreme circumstances. DO NOT ARRANGE TO LEAVE BEFORE THE FINAL EXAM.

IMPORTANT DATES: Last day to drop, no tuition liability Feb. 6
Last day to drop without dean's signature Feb. 23, 5pm

EXAMS: Exam 1 **Tentative** Monday, Feb. 12
Exam 2 **Tentative** Monday, March 26
Final Exam **Definitely** Monday, May 14, 1:30pm-4:15pm

(over)

MATERIAL COVERED AND TENTATIVE WEEKLY SCHEDULE

Overview of course; Review (?) of eigenvectors, eigenvalues; diagonalizability of symmetric matrices

More eigenvectors: solving ODEs

Fourier series as analogy – orthogonality. View as least squares problem / best approximation in subspace.

Discrete Fourier and the FFT

Fourier Integrals (transform)

Brief Introduction to Complex differentiation

Brief introduction to Complex integration

Solving dynamical problems via Fourier methods

Heat equation vs. wave equation

Introduction to finite elements

Solving first-order PDES via odes

Nonlinear effect in traffic model / transport equation

Euler equations and Navier-Stokes

Applications Revisited

Along the way, we will discuss scaling and dimension, singular vs. regular perturbations, and use Matlab PDEtoolbox to do calculations and simulations.