Math 172 Numerical Methods for Partial Differential Equations Spring 2004

Instructor:	Steven E. Pav
Phone:	858 534 2126 (4-2126)
Email:	SPAV@UCSD.EDU
Office:	5763 Applied Physics & Mathematics Building (APM)
Office Hours:	tentatively: M 5:00p-5:50p, Tu 1:10p-2:00p, We 4:00p-4:50p
Meeting Times:	MWF 3:00p-3:50p
Room:	HSS 1315
Textbook:	*Numerical Treatment of Partical Differential Equations*, and *Mathematics 172 Notes on the Finite Element Method*, both by Randolph E. Bank, Peter Rentrop, and Donald R. Smith. To be made available from A. S. Soft Reserves. You may also wish to consult *The Mathematical Theory of Finite Element Methods*, by Susanne C. Brenner and L. Ridgeway Scott, *Partial Differential Equations : Analytical and Numerical Methods*, by Mark S. Gockenbach, and *Finite Difference Schemes and Partial Differential Equations*, by John C. Strikwerda. I will try to put some or all of these on reserve at the library.
Course Webpage:	http://scicomp.ucsd.edu/~spav/class/2004S-M172/
Final Exam:	Monday June 7, 3:00p-6:00p

Catalogue Description. *172. Numerical Partial Differential Equations. (4) Finite difference methods for the numerical solution of hyperbolic and parabolic partial differential equations; finite difference and finite element methods for elliptic partial differential equations.*

Course Description. Scientists often model physical systems with partial differential equations ("PDEs"). Analytic solutions exist only for the most elementary PDEs; the rest must be tackled with numerical methods. These can roughly be broken into two types: the finite difference and the finite element methods. The finite difference method approximates the solution of a PDE at a number of points in space. The finite element method attempts to find the best approximate solution to a PDE among some finite set of simple functions. In the end, both methods require solution of a set of linear equations. After an introduction to PDEs in general, we will look at each method, including theoretical and practical aspects, consistency, stability and convergence.

Grading Policy. It is my belief that *any* grading scheme will be disagreeable to *some* student; the best grading scheme one can hope for is one that is agreeable to the majority, and applies equally to all students.

Grading in this class will be based upon performance in homeworks, on a programming project, and two examinations. The final quarter grade is subdivided as follows: Homework: 30%; Project: 10%; Exams: 30% each. It is expected that the exams will be challenging, and grades will be curved.

The dates and times for the exams are listed in this syllabus: The first exam is Monday, May 3, during the discussion section at 5pm. The second exam is during the final exam period for the class, Monday June 7, at 3pm. The second exam is *not* a comprehensive final.

If you have known conflicts with any of these exams, I encourage you to notify me immediately. Legitimate, documented, excuses for missing an exam will be dealt with individually.

Homework. It is expected, and encouraged, that students will work together on the homeworks. This saves time (yours and mine), builds leadership, and encourages cooperation. Each student must submit their own homework, written in their own hand (please no printouts, photocopies or faxes). Please list on your homework the names of the other students you worked with.

A number of the homework problems ask you to write a program in FORTRAN. You may do this if you wish, but I encourage you to instead write the program in Matlab (or even better, the free Matlab clone Octave). If you choose to write in Matlab, do not use Matlab's finite difference toolkit or otherwise "cheat" by using Matlab's high-level functions. It should be clear from the wording of the problem what you are supposed to program; if not, ask me. You may talk to one another about programming assignments, but you should write your own programs. Please do *not* share code.

Project. The project will consist of a longer programming assignment. You will be able to choose from a limited number of different projects. Please do not consult one another for your project, and do not share code.

Getting Help. I encourage you to attend my office hours. Unfortunately there is no TA for the class.

Academic Integrity Students are expected to adhere to the University's Policy on Integrity of Scholarship, found in the UCSD general catalogue. Minimum punishment for cheating on a exam is a score of zero on that exam.

Course Webpage. The course page, (http://scicomp.ucsd.edu/∼spav/class/2004S-M172/) will include this syllabus and any updates, general announcements, handouts and other materials.

Course Schedule. The lecture schedule is tentative, but the exam schedule is exact. Section numbers are those of *Numerical Treatment of Partical Differential Equations*, except those on FEM, which are from *Mathematics 172 Notes on the Finite Element Method*.

week 1	M Mar 29	PDE review: §1.1
	W Mar 31	PDE review: §1.2
	F Apr 02	PDE review: §1.3
week 2	M Apr 04	PDE review: §1.4
	W Apr 07	FDM intro: §2.1
	F Apr 09	FDM intro: §2.2
week 3	M Apr 12	FDM intro: §2.3
	W Apr 14	FDM parabolic: §3.1
	F Apr 16	FDM parabolic: §3.1, 3.2
week 4	M Apr 19	FDM parabolic: §3.2, 3.3
	W Apr 21	FDM parabolic: §3.3, 3.4
	F Apr 23	FDM parabolic: §3.5
week 5	M Apr 26	FDM parabolic: §3.6
	W Apr 28	FDM parabolic: §3.8
	F Apr 30	FDM parabolic: §3.8, 3.9
week 6	M May 03	FDM hyperbolic: §4.1
	M May 03	**5:00pm**: Exam 1 covering §1.1–1.4, 2.1–2.3, 3.1–3.6,3.8,3.9
	W May 05	FDM hyperbolic: §4.2
	F May 07	FDM hyperbolic: §4.2
week 7	M May 10	FDM hyperbolic: §4.5
	W May 12	FDM elliptic: §5.1
	F May 14	FDM elliptic: §5.2
week 8	M May 17	FDM elliptic: §5.3
	W May 19	FEM elliptic: §1.1
	F May 21	FEM elliptic: §1.2
week 9	M May 24	FEM elliptic: §1.3
	W May 26	FEM elliptic: §1.4
	F May 28	FEM elliptic: §1.5
week 10	M May 31	Memorial Day: no class
	W Jun 02	FEM elliptic: §1.6
	F Jun 04	FEM elliptic: §1.7
finals	M Jun 07	**3:00pm**: Exam 2 covering §4.1,4.2,4.5,5.1–5.3,1.1–1.7