Syllabus

Day/Time and Room: MWF, 9:00-9:50am, ECCR 118

Instructor: Michael Sprague, ECOT 322, 303-492-2646, Michael.Sprague@Colorado.edu

Office Hours: MW 2:00 - 3:30 (You're welcome to try other times on MWF; Tuesday and Thursday are bad days for Mike)

Course Description (from 2003-2004 catalog): Continuation of APPM/MATH 4650. Examines numerical solution of initial-value problems and two-point boundary-value problems for ordinary differential equations. Also looks at methods for solving partial differential equations.

Prerequisites: APPM/MATH 4650, and computer programming experience. Differential Equations is also strongly suggested.

Text:

- R. Burden and J. Faires, *Numerical Analysis*, 7th ed., Brooks/Cole, 2001.
- Note that there are mistakes in the textbook. If your solution doesn't match the solution given in the back of the book, there might be a mistake. Many errata are listed on the course web-page.

Course Web Page: Most course materials (including homework and solutions) will be available on the the following web page: http://amath.colorado.edu/courses/4660/

Grading: The final grade will be computed as follows:

1. Homework: 50%
2. Midterm Exam (2 March): 15%
3. Final Project: 20%
4. Final Exam (5 May): 15%

Lecture & Reading:

- Please read material before coming to class (at least skim it!); some knowledge of the material will promote better class discussion.
- While class participation is not a requirement, it is encouraged, and it may influence grades in borderline cases. Your class participation is greatly appreciated!
- Students are responsible for all information discussed in class; if you skip class, make sure you get any important information.
- During lecture, if you read unrelated material, (*e.g.* a newspaper) or sleep, be prepared to be the focus of class attention.

Two E-mail Lists:

- There will be one class list in which you are automatically enrolled. Important class announcements will be sent through this channel. You are responsible for this information.
- A second list will have voluntary enrollment. I will cc this list when I respond to homework questions via e-mail. The student's name from the original question will be removed. Information on subscribing to this list will be given later.

Homework:

- The homework will consist of theoretical problems, programming exercises, and essay questions.
- Homework will typically be distributed on Wednesday and is due by 5:00 pm two weeks later (in-class or in box outside Mike's office). Late homework turned in before 5:00 pm on Thursday will be subject to a 25% penalty. Homework turned in before 5:00 pm on Friday will be subject to a 50% penalty. Homework will not be accepted after 5:00 pm on Friday.
- You are allowed and encouraged to work together on homework. However, you must write up your own solutions and write your own code. Any code in your programs must be *typed* in by you alone; no cutting and pasting code from another source (unless supplied by the instructor).
- Please show and adequately explain your work. Writing that is difficult to read will NOT be graded.
- All assignments will be weighted equally. Since homework is due only every two weeks, no assignments will be dropped. Note that some assignments will take considerably more time than others; please plan accordingly.
- There is no TA (or grader) for this class; often only several problems of each assignment will be graded.

Miscellaneous Items:

- Students are expected to have a calculator for exams.
- All programming must be done in MATLAB. However, Mathematica or Maple may be used to aid in completing homework.
- Final projects will be completed in groups of three; more information to come.

Schedule (Subject to Change)

Date	Topics	Reading
M Jan 10	Class Intro, Motivation, and IVPs	5.1
W Jan 12	Euler's Method	5.2
F Jan 14	Higher-Order Methods	5.3
M Jan 17	NO CLASS - MLK Jr. Day	
W Jan 19	Runge-Kutta Methods	5.4
F Jan 21	Error Control	5.5
M Jan 24	Multistep Methods	5.6
W Jan 26	Variable Step-Size Methods	5.7
F Jan 28	Extrapolation Methods	5.8
M Jan 31	Higher-Order Equations and Systems of ODE's	5.9
W Feb 2	Stability	5.10
F Feb 4	Stiff Differential Equations	5.11
M Feb 7	Review of IVP's	
W Feb 9	Least Squares	8.1
F Feb 11	Orthogonal Polynomials and LS	8.2
M Feb 14	Chebyshev Polynomials and LS	8.3
W Feb 16	Rational Function Approximation	8.4
F Feb 18	Trigonometric Poly Approximation	8.5
M Feb 21	FFT	8.6
W Feb 23	Fixed Points for Several Variables	10.1
F Feb 25	Newton's Method	10.2
M Feb 28	Review	
W Mar 2	Midterm Exam	
F Mar 4	Quasi-Newton Methods	10.3
M Mar 7	Steepest Descent Techniques	10.4
W Mar 9	Continuation Methods	10.5
M Mar 11	Shooting Methods	11.1
M Mar 14	Shooting Methods Con't	11.2
W Mar 16	Finite-Difference Methods	11.3
F Mar 18	Finite-Difference Methods Con't	11.4
M Mar 21		
W Mar 23	Spring Break	
F Mar 25		
M Mar 27	Rayleigh-Ritz (Variational) Method	11.5
W Mar 30	TBA	
F Apr 1	TBA	
M Apr 4	F.D. - Elliptic Problems	12.1
W Apr 6	"	12.1
F Apr 8	F.D. - Parabolic Problems	12.2
M Apr 11	F.D. - Hyperbolic Problems	12.3
W Apr 13	Review of F.D. Methods	12.4
F Apr 15	Introduction to Finite Elements	12.4
M Apr 18	Finite Elements in 1-D	
W Apr 20	Isoparametric Mappings	
F Apr 22	Gauss Quadrature with F.E.	
M Apr 25	Local to Global Mappings	
W Apr 27	2-D Finite Elements	
F Apr 29	REVIEW	
Th May 5	**FINAL EXAM (7:30am - 10:00am)**	