Mathematics 225
Scientific Computing II
Spring Term 2003

1. **Bulletin Description:**
   Scientific Computing II. (QR) M, QID Approximation theory: Fourier series, orthogonal polynomials, interpolating polynomials and splines. Numerical differentiation and integration. Numerical methods for ordinary differential equations: finite difference methods for initial and boundary value problems, and stability analysis. Introduction to finite element methods. Prerequisite: Mathematics 224 and familiarity with ODEs at the level of Mathematics 111 or 131. Instructor: Staff. One course. C-L: Applied Science. (Description approved fall 2001.)

2. **Role in our curriculum:**
   The material in Scientific Computing II is indispensable for research in many areas of applied mathematics, especially those in which differential equations are used to represent physical, chemical, biological, or social processes. Examples of such areas include fluid dynamics, industrial processes, and mathematical physiology. This course is a prerequisite for Mathematics 226 and 227, Numerical Partial Differential Equations, parts I & II.

3. **Place and Times:**
   Room 120 Physics Building
   Tuesday and Thursday, 10:55–12:10.

4. **Instructor:**
   Harold Layton
   Electronic mail: `layton@math.duke.edu`
   Office: Room 219B Physics Building
   Office hours: Mondays, 2:30 – 3:30; Thursdays, 2:30-3:30

5. **Course webpage:**
   `http://www.math.duke.edu/~layton/225/`

6. **Textbooks:**
   An Introduction to Numerical Analysis, 2d edition,
   by Kendall E. Atkinson
   ISBN: 0-471-62489-6

   Scientific Computing
   by John Trangenstein, on-line at:
   `http://www.math.duke.edu/faculty/trangenstein/math224/book.pdf`

7. **Prerequisites:**
   Mathematics 224 (or near equivalent, with permission of the instructor) and familiarity with ODEs at the level of Mathematics 111 or 131.

8. **Homework:**
   Regular problem sets. Problem answers should be typewritten and graphs should be electronically produced. Materials must be submitted in hard-copy form.

9. **Project:**
   An in-depth paper that extends a method covered in class or treats a related method. The paper may be related to a mathematical or scientific problem. If time allows, students will describe their projects in brief classroom presentations.

10. **Quizzes:**
    Basic concepts will covered in mid-term and final quizzes. The final quiz will be administered at the university designated time: 9:00 AM on Thursday 1 May 2003.

11. **Course Grades:**
    Course grades will be based on the problem sets, the quizzes, the project, class attendance, and class participation.

12. **Honor and Character:**
    It is the policy of Duke University, and the belief of the instructor, that honesty and the cultivation of good character are more important than academic achievement or the appearance of academic achievement. Indeed, good character is the foundation of all academic and scholarly endeavor.

    Students are encouraged to work together on problem sets: they should feel free to talk among themselves about solution methods, ways to overcome particular difficulties, and methodological aspects of programming or analysis. However, all students are expected to do their own programming, report their own results, and write their own responses. Moreover, students should not discuss specific homework problems with persons who have previously taken this course from me.

13. **Policy Modifications:**
    The instructor reserves the right to make minor adjustments to course policies.