MA 405.002 Spring 2005 Course Syllabus

**Time:** MWF 9:10-10, HA 320


**Instructor:** R. E. Hartwig, HA 217, hartwig@math.ncsu.edu, tel 515-2385; office hours MWF 12:30-1:30 or by appointment; webpage: http://www.math.ncsu.edu/ hartwig/Teaching

**Prerequisites:** MA 241, Coreq MA 242

**Goals & Objectives:** This is a (first) course in Linear Algebra and Matrix theory, which serves as a preparatory course for and crucial link to, many graduate courses in pure and applied science. The course will be presented in a staircase fashion, starting with Basic Matrix Algebra and ending with Quadratic Forms. We shall use the textbook as a general guide to the topics given below, but where the need arises, supplementary material will be presented.

**Topics to be Covered with Estimated time**

1. **Basic Matrix Algebra** (Ch 1)(3 lec).
   Definitions, Notations, Special Operations, Matrix Algebra, Special Matrices

2. **Linear systems and Gaussian elimination** (Ch 1)(5 lec)
   Elementary matrices, Row-Echelon Form, homogeneous and non-homogeneous systems,

3. **L-U Factorization and Determinants** (Ch 1,2)(3 lec)
   Doolittle/Crout algorithm, Cholesky Factorization, Properties of determinants, leading principal minors

4. **Vector Spaces** (Ch 3)(8 lec).
   subspaces, linear dependence, bases, dimension, the 4 vector spaces of A.

5. **Norms and Orthogonality** (Ch 5) (7 lec)
   Lengths, inner-products, orthogonal sets and bases, Gram-Schmidt procedure, QR factorization, least squares.

6. **Eigenvalues and vectors** (Ch 6) (7 lec)
   Basic Properties, eigenspaces, special matrices, diagonalization

7. **Triangular Canonical Forms** (Ch 5) (3 lec)
   Jacobi and Schur Forms, Normal Matrices, Principal Axes Theorem

8. **Quadratic Forms**. (Ch 6)(3 lec)
   Examples of QFs, Kinetic/Potential energy, Variance, Taylor Expansion and the Hessians, Inertia.

**Homework:** Homework will be assigned after each lecture, but will generally not be collected. We will go over selected hw problems as time permits. It is extremely important that you do the hw problems in a timely manner because (a) you need practice and (b) the material in one section depends on that of a previous section.

**Grading Policy:** Your grade is determined by: 4 Tests (60%), (Approx Dates: Feb 4, Feb 21, Mch 30, Apr 25), a cumulative final (35%) on Friday May 6, 8-11 am and possible pop-quizzes (5%). Good performance on tests will depend on understanding class discussion and homework.

**Matlab & Maple:** Some Matlab and/or Maple exercises will be set. It is essential that you learn to use one/both of these packages. (Matlab was written for matrices and was introduced to the world at the Raleigh SIAM meeting of 1982)

**Other Remarks**

(i) Credit is not allowed for both MA 305 and MA 405

(ii) please do not email me with reasons why you missed class! With a large section it is infeasible for me to email you individually. If you must talk to me, please come past my office.

(iii) please take down the tel. nos and email addresses of at least two of your fellow students.

(iv) If you miss class, it is YOUR responsibility to (a) copy the notes, (b) study the notes (c) find out what hw has been set (d) find out if test times or hw due dates, have been changed – if any.

(v) Please do not set your dental/doctor-appointments/interview/field-trips/ etc etc...on top of the test dates!

(vi) Make-up test will only be given for solid excuses with prior permission. Documentation is expected.

(vii) Keep ALL your old quizzes and homeworks, for future reference.

(viii) Please keep your eos email account in order, so we can reach you.

(x) We have 39 lectures plus 4 tests.

**Dates:** M.L.King day = Jan 17, Spring break = Mch 7-11, Easter = Mch 24-25 Last day of classes Ap 29.