MATHEMATICS 5101

Mathematical Principles in Science I: Linear Mathematics in Finite Dimensions

Time: MWF 9:10-10:05am

Prerequisites: Basics of matrix algebra (as e.g. in Math 2568 or 2174); mathematical maturity

Texts: 1.*Introduction to Linear Algebra* by L.W. Johnson, R.D. Riess,and J.T. Arnold (Chap. 4 in the 3rd or 4th Edition, Chap. 5 in the 5th Edition)

2.*Linear Algebra and Its Applications* by G. Strang

Web site: https://people.math.osu.edu/gerlach.1/math5101

Syllabus (in essence): Vector spaces
Space of duals (= covectors = linear functionals)
Inner products
Linear operators
Eigenvalues & eigenvectors
Adjoint of an operator
Quadratic forms
Small oscillations
Singular value decomposition

Homeworks: One homework set every week, generally handed out each Friday and due the following Friday AT THE START OF CLASS.

Midterm Exam: TBA, whether and when; if so, to be announced two weeks in advance.

Final Exam: One take-home comprehensive final

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Homework policy: For each assignment, TEAMS are allowed and even encouraged, with a limit of 3 persons per team. Each team submits ONE SET OF SOLUTIONS, signed by each member, and every team member receives the same grade.

Teams disband after each assignment. Teams then re-constitute for every assignment. This way you are encouraged to select partners who contribute to the final product that you hand in.

Grading Guidelines: Each assignment paper will be graded for mathematical correctness AND PRESENTATION. Separate problems and their solutions must start on **separate sheets of paper**. *Remember: Trees are a crop to be harvested: Paper is an inexpensive staple commodity.*

- Points will be deducted for hard-to-read writing, sloppiness, incoherent or insufficient explanation, or for lack of supporting rationale.
- The solutions should be presented so that your fellow students AND YOUR PROSPECTIVE CLIENT could read them and follow both the calculations and logic. **This means you *must* write your solutions in complete sentences where appropriate, describing your reasoning. This approach will also help you to develop the ability to explain your reasoning to scientific collaborators who lack your mathematical training. The worked examples in the spiral bound text illustrate a reasonable level of English prose (feel free to add more detail if that suits you, but you forfeit credit for inadequate explanation).**

Each assignment (8 or 9 total) will consist of approximately 100 possible points, and the Final Exam will be worth about 400 points. There is a total of about 1000 points. Late papers will not be accepted except in extreme situations with documented excuse. It is the student's responsibility to be aware of all instructions that are delivered during class, including departures from general assignments.

Use of software: You are encouraged and sometimes obligated to use a software package such as Maple or Matlab. So, practice with some linear algebra software soon, and get used to working with it. All routine calculations should be checked this way. If we want you to do hand calculations, we will make it explicit. Even then, check yourself. Moreover, when you use software, you must acknowledge that you did, and support the output with some form of explanation: why it was used, and an interpretation of any answer that is not just a routine calculation. A simple solution consisting of output from Matlab or Maple is not sufficient. Common sense should rule here.