

## ESI 4327C: Matrix and Numerical Methods in Systems Engineering

1. Catalog Description: *Credits: 4.* Theory and application of vector, matrix and other numerical methods to systems problems. Simultaneous linear equations, characteristic values, quadratic forms, error analysis, use of series, curve fitting, nonlinear equations, discrete methods. The laboratory sessions will emphasize numerical solutions using MATLAB.
2. Pre-requisites: MAC 2313, MAP 2302
3. Course Objectives:
  - Understanding the concepts behind the techniques presented in the course
  - Developing facility with the techniques themselves, and being able to solve small size problems analytically
  - Learning how to implement the methods in the MATLAB programming environment (ability to program in at least one high level language such as C, C++, FORTRAN, VB, etc. will be useful, but is not a requirement)
4. Contribution of course to meeting the professional component: This course teaches the basic concepts in the theory and applications of vector, matrix and other numerical methods to systems problems. Students will develop and enhance their ability to address various problems applying numerical methods and modern software (MATLAB).
5. Relationship of course to program outcomes: This course meets ABET requirements in the following ABET criteria: apply knowledge of mathematics, science and engineering; design and conduct experiments, as well as to analyze and interpret data; identify, formulate and solve engineering problems; understand the impact of engineering solutions in a global and societal context; recognize the need for, and engage in life-long learning; understand contemporary engineering issues; use the techniques, skills, and modern engineering tools necessary for engineering practice; integrate systems using appropriate analytical, computational and experimental practices.
6. Instructor: Petar Momčilović
  - a. Office location: 479 Weil
  - b. Telephone: (352) 392-1464 x2053
  - c. E-mail address: momcilovic@ufl.edu
  - d. Web site: [www.ise.ufl.edu/momcilovic/](http://www.ise.ufl.edu/momcilovic/)
  - e. Office hours: TW 9 or by appointment

The best way to contact me is via email. However, discussing some mathematical topics over email cannot always be done efficiently. I reserve the right to request that you attend office hours if answering your question via email will be overly complicated. I am not always at my desk so phone calls might not be answered. Do not use voicemail or Sakai as a means of communication as I do not check them regularly. I reserve the right to request students attend office hours when stopping by my office during non-office hour time periods.

7. Teaching Assistants: Amir Motaei / Bradley Bean
  - a. Office location: 202 Weil / 405B Weil
  - b. Telephone: –
  - c. E-mail address: motaei@ufl.edu / bbean@ufl.edu
  - d. Office hours: MR 6 / T3-4, R7-8
8. Meeting Times: M 7-8, W 8, F 7-8
9. Schedule: –
10. Meeting Location: FLG 220
11. Material and Supply Fees: none
12. Textbooks:
  - a. Title: Introduction to Linear Algebra
  - b. Author: Gilbert Strang
  - c. Wellesley Cambridge Press, 4th edition
  - d. ISBN: 978-0-9802327-1-4.
  - a. Title: Numerical Methods and Optimization: An Introduction
  - b. Authors: S. Butenko and P. Pardalos
  - c. Chapman and Hall, 1st edition
  - d. ISBN: 1466577770.
13. Recommended Reading: –
14. Course Outline:
  - Linear algebra: systems of linear equations, matrices, linear combinations, matrix multiplication, Gaussian elimination, Gauss-Jordan method, matrix inverse, factorization, linear vector space, subspace, spans, four fundamental spaces, independence, basis, dimension, solutions of  $Ax = b$ , orthogonality, projections and projection matrices, least squares estimation, orthonormal basis, Gram-Schmidt algorithm, determinant, Cramer's rule, eigenvalues and eigenvectors, diagonalization, asymptotic properties, symmetric matrices, positive definite matrices.
  - Numerical methods: errors, Taylor expansion, gradient, Hessian matrix, Jacobi matrix, non-linear equations, bisection, fixed-point methods, Newton's method, polynomial interpolation, numerical differentiation/integration, ordinary differential equations
15. Attendance and Expectations: Attendance is mandatory – you are responsible for the announcements made in class. Students are expected to know the material covered in the prerequisite courses. When necessary, they are expected to relearn material from these courses on their own.

**This is not a course where you can do well on exams solely by blindly applying formulas.** In order to get the most out of the course, try to stay ahead. By the weekend, make sure you have at the least reviewed the material covered in the lectures and readings of the preceding week. In addition to reading, working out extra exercises on your own will help in improving your understanding of the material. With diligent practice, you can prepare yourself to the point where, on exams, instinct takes over and the problems seem straightforward.

16. Grading: 1/3 midterm 1, 1/3 midterm 2, 1/3 final.

Exams: 2 midterms on October 7 (Wednesday) and November 9 (Monday) – subject to room availability; final on December 16, 2015 (Wednesday) at 3:00 p.m.

Exam Grading Appeals: every effort will be made to ensure that grading is as objective and fair as possible. If you believe that there is an error in the grading, please submit, in writing, an appeal within *one week* of your exam being returned. However, please be advised that if you submit such an appeal, the entire exam will be regraded to ensure that all parts are properly graded. As such, your grade on the exam could increase or decrease based on the secondary grading.

17. Grading Scale: The final letter grade will be determined primarily by the curve. The break between “B” and “B-” will be approximately set at the average of total scores of students receiving letter grades. Letter grades will be monotonic in total course scores. **Your grade will be solely based on your performance in this course and not on outside factors like your wish to graduate by a certain date.** Grades are not subject to negotiation. Being close to the next higher grade is not a relevant issue for discussion of a grade adjustment.

A C- will not be a qualifying grade for critical tracking courses. In order to graduate, students must have an overall GPA and an upper-division GPA of 2.0 or better (C or better). Note: a C- average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

18. Make-up Exam Policy: You are expected to be present without exception and to plan any travel around these dates accordingly. Medical emergencies are of course excluded if accompanied by a doctor’s note. A note indicating that you were seen at the health center the day of the exam is not sufficient documentation of a medically excused absence from an exam. The note must say that you were medically unable to take the exam.

If you fail to take the exam on the assigned day and do not have a valid excuse, there will be no make up exam and you will be given a zero (0) on the exam. Employment interviews, employer events, weddings, vacations, etc. are not excused absences.

19. Honesty Policy: All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course and all others.

Any form of cheating will be penalized.

20. Accommodation for Students with Disabilities: Students Requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.

UF Counseling Services: Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:

- UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, psychological and psychiatric services.
- Career Resource Center, Reitz Union, 392-1601, career and job search services.

21. Software Use: All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.