

Class meets: MW 4:00 - 5:15 in MH 452

Professor: Dr. Tyler McMillen

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Office hours: MW 3:00 - 3:50, TF 12:00 - 1:00, or by appointment.

Text: Required – *MATLAB: An Introduction with Applications*, by Amos Gilat, 3rd edition.
Optional – *Numerical Computing with MATLAB*, by Cleve Moler.

Course Goals: This course is intended to help you become comfortable using personal computers to solve quantitative problems, as well as to experiment with mathematical concepts and techniques. A variety of problems from mathematics, science and engineering will be considered to illustrate the problem-solving process. In addition, various topics from the four-semester calculus and linear algebra sequence will be studied from a computational viewpoint. You will gain experience in the use of MATLAB, a state-of-the-art software package for interactive numerical and symbolic computation, as well as in writing programs of your own. What you learn will prove to be useful in many of your future courses in mathematics, particularly those involving numerical computation, mathematical modeling, and simulation. The skills you will develop here are also invaluable for **any** career in mathematics, science or engineering.

The text is designed to provide you with basic instruction in MATLAB and its Symbolic Math Toolbox. We will cover most of this material. We will also make liberal use of the extensive built-in help files available in MATLAB. The goal is to become proficient enough in using these tools to be able to quickly and efficiently solve problems using the computer.

Course Structure: The best way to learn how to do mathematical computation is to write programs. Thus, a major component of this course is writing code. You will write many small programs as part of the homework, and larger programs as part of the projects.

Homework: At the end of the syllabus is a list of homework problems. Do these problems as we go through the material. Homework will not be collected during the semester. Rather, you will keep a notebook with all of your homework solutions. This will be collected at the end of the semester. Your homework grade will be calculated as the percentage of homework problems you successfully complete. I expect the homework notebooks to be neat and complete, i.e. fully worked out exercises, not just the answers.

Projects: You will do two projects for this course. These can be either two parts of one large project, or two smaller projects. You will pick a topic, and prepare a presentation using MATLAB. The projects can be done in groups of one, two or three students.

Exams: There will be one midterm, tentatively scheduled for Oct. 19, and a final exam.

Grading: The final grade will be based on the homework, projects and exams, and calculated as:

$$20\% \text{ homework} + 40\% \text{ projects} + 40\% \text{ exams}$$

I reserve the right to change your grade by $\pm 5\%$ based on your participation.

Possible project topics:

- How does Google work? Write a code to implement the PageRank algorithm used in the Google search engine.
- What is the best strategy in blackjack? Write a code to implement a learning algorithm that learns the best way to play blackjack.
- Chaos & Fractals. Very complicated structures can emerge from simple mathematical rules. Explain what chaos is and how it arises, how it is related to fractals, and exhibit such structures in MATLAB.
- The falling chain. What falls faster, the end of a chain or a ball? Write a program to solve the differential equations governing the falling chain and compare the results with those of a free falling object.
- Random polynomials and matrices. Suppose you pick $n + 1$ real numbers a_0, a_1, \dots, a_n at random. What is the probability that the polynomial $p(x) = a_n x^n + a_{n-1} x^{n-1} + \dots + a_1 x + a_0$ has a real zero?

The above list is not meant to be exhaustive, but rather a few suggestions. You may do your project(s) on any topic you would like, so long as it involves a fair amount of mathematical computation. For the project(s), you will choose a topic and members of your group. By Sep 16 you will submit your topic(s) along with a brief description of what you are going to do. Presentations will be on Oct 12 & 14 for the first project and Dec 7 & 9 for the second project.

Additional comments: Should you be forced to miss a class, it is your responsibility to obtain the lecture notes and other important information from me or one of your classmates. As a courtesy to me as well as to your classmates, please arrive on time and remain seated until class is dismissed. If you absolutely must leave early, please let me know and sit near the door, so that you can leave with minimal disruption to the class. Please turn off all pagers, cell phones, and PDAs.

It is very important in any mathematics course to attend class, to do all assigned reading and homework conscientiously and thoroughly, and to get any questions you might have cleared up as quickly as possible. You are strongly encouraged to get help in class, before or after class, during scheduled office hours, or any other time you can catch me. You are also welcome to contact me via e-mail or phone. Studying with your fellow students is also strongly encouraged. However, your final write-up must be in your own words. Any references, including those of other students, must be cited.

To get a better sense of the incredible range of applications of MATLAB, I recommend that you browse the built-in demos, and/or visit the creators of MATLAB at www.mathworks.com.

No prior computer experience is necessary to enjoy and do well in this course. What is required is an open mind and a willingness to put forth regular effort. Plan to consistently spend at least three hours on homework for each hour spent in class (that is, nine additional hours per week). Since everyone learns at a different rate, you may find that you require more time. You will need to be able to access MATLAB outside of class. This can be accomplished in several ways. You can purchase the Student Edition of MATLAB and install it on your

home computer. You may also use the Math Department computer lab in MH 26, or the NSM computer lab in MH 553. These are generally open about 40 hours per week, and all of the computers have MATLAB. If you ask nicely, some instructors will even allow you to work quietly in the back of MH 452 while they teach their class.

Note on budget cuts: As you are no doubt aware, severe budget cuts have been imposed on the Cal State system this year. This has resulted in increased fees for the students and furloughs and pay reductions for the staff and faculty. Fortunately, this will not have a great effect on this particular course. It will mean that one class will be cancelled (Oct. 21), and a few Fridays I will not be available for office hours.

Academic dishonesty: Students who violate university standards of academic integrity are subject to disciplinary sanctions, including failure in the course and suspension from the university. Since dishonesty in any form harms the individual, other students and the university, policies on academic integrity are strictly enforced. I expect that you will familiarize yourself with the academic integrity guidelines found in the current student handbook.

Academic dishonesty is cheating – obtaining or attempting to obtain credit for work by the use of any dishonest, deceptive, fraudulent, or unauthorized means, or helping someone else commit such an act. Examples include, but are not limited to:

1. Unacceptable examination behavior – communicating with fellow students, copying material from another student's exam or allowing another student to copy from an exam, possessing or using unauthorized materials, or any behavior that defeats the intent of an exam.
2. Documentary falsification including forgery, altering of campus documents or records, tampering with grading procedures, fabricating lab assignments, or altering medical excuses.
3. The first violation of these standards will result in a score of zero on the assignment or exam. A second violation will result in a grade of F for the course, and will be reported to the Dean of Students. You are encouraged to see me prior to submitting an assignment or taking an exam if you have any questions regarding these issues.

Emergency information: In the event of an emergency such as earthquake or fire:

- Take all your personal belongings and leave the classroom.
- Use the stairways located at the east, west, or center of the building. Do not use the elevators. They may not be working once the alarm sounds.
- Go to the lawn area towards Nutwood Avenue, at least 150 feet from the nearest building. Stay with class members for further instruction.
- For additional information on exits, fire alarms and telephones, Building Evacuation Maps are located near each elevator.
- Anyone who may have difficulty evacuating the building, please see your instructor.

- Important dates:** Tues, Sep 8 – Last day to ADD with a permit
 Tues, Sep 8 – Last day to DROP without a grade of “W”
 Fri, Oct 2 – Last day to DROP with a grade of “W”
 Fri, Nov 13 – Last day to drop with a grade of “W” for a
 “serious and compelling reason”
 Mon, Sep 7 – Labor day (no class)
 Wed, Oct 21 – Furlough day (no class)
 Wed, Nov 11 – Veteran’s day (no class)
 Nov 23 - 29 – Fall recess (no class)

Tentative schedule:

Week	Monday	Wednesday	Week	Monday	Wednesday
Aug 24, 26	Intro, ch. 1	ch. 1	Oct 19, 21	Midterm	no class
Aug 31, Sep 2	ch. 2	ch. 2	Oct 26, 28	ch. 7	ch. 8
Sep 7, 9	no class	ch. 3	Nov 2, 4	ch. 8	ch. 9
Sep 14, 16	ch. 3	ch. 4, proj. topic due	Nov 9, 11	ch. 10	no class
Sep 21, 23	ch. 4	ch. 5	Nov 16, 18	ch. 10	ch. 11
Sep 28, 30	ch. 5	ch. 6	Nov 23, 25	Fall break (no class)	
Oct 5, 7	ch. 6	ch. 7	Nov 30, Dec 1	ch. 11	review
Oct 12, 14	presentations		Dec 7, 9	presentations	

Homework problems:

Chapter	Problems
1	2, 4, 6, 8, 10, 12, 14, 16, 18, 19, 20, 24
2	2, 4, 6, 8, 9, 10, 12, 14, 16, 18, 20
3	1, 2, 4, 6, 8, 10, 12, 13, 14, 15, 16, 18
4	1, 3, 4, 5, 6, 8, 12, 14
5	5, 6, 8, 10, 15, 19
6	2, 3, 6, 7, 9, 10, 12, 14
7	1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 21
8	2, 6, 8, 10, 11, 12
9	2, 4, 6, 7, 14
10	2, 4, 7, 9, 11, 12, 13, 18, 20, 22
11	2, 4, 5, 6, 8, 12, 14

The professor reserves the right to change the content of the syllabus at any time.