CME200/ME300A Syllabus

> **All** course materials, including assignments, grades and announcements are published on the coursework website for CME200 (go to http://coursework.stanford.edu). With the exception of this syllabus, hard copies of course materials will **NOT** be distributed in class.

CME 200 provides a solid background in linear algebra and matrix computations that is needed to solve engineering problems. A good background in matrix computations and linear algebra is essential for the engineer because many engineering problems require the solution of generally very large systems of nonlinear or linear equations. With the strong base provided in this course, more advanced algorithms used in research or industry can be studied and understood. The course material is supported by engineering examples presented in the lectures, and consolidated by weekly workshops and weekly assignments.

Assignments and exams cover both *application* of new algorithms and the *mathematical theory* on which they are based. CME200 is not an applications course. We discuss theory as well as applications, and course assessment is based on both your theoretical knowledge, as well as your ability to apply this knowledge to engineering problems.

Instructor

Prof. Gianluca Iaccarino, jops@stanford.edu
Prof. Iaccarino will teach all Monday and Wednesday lectures. The Friday workshops will be taught mostly by the TAs.

Teaching Assistants

The course has 6 teaching assistants:
Neeloy Banerjee (neeloy@stanford.edu)
Konstantin Stulov (kstulov@stanford.edu)
Lan Huong Nguyen (lanhuong@stanford.edu)
Nolan Skochdopole (naskoch@stanford.edu)
Saman Ghili (samang@stanford.edu)
Nicolas Kseib (nkseib@stanford.edu)

All TAs are graduate students in ICME or ME.

Neeloy is the dedicated TA for the SCPD students. If you are an SCPD student, you will receive an e-mail at the start of the quarter which outlines the SCPD office hours and the procedures for homework hand-in and hand-back as well as midterm and final.

Office Hours

Professor Iaccarino's office hours are Wednesdays from 1:00 – 2.30pm in the open workspace, lower level Huang (in front of the ICME suite). As noted above, SCPD students will confer with Neeloy directly to set up office hours. The TAs will run extensive hours starting Thursday September 25. The finalized schedule will be announced on Wednesday September 24.

Online Support

We will be using an interactive course bulletin system called Piazza, which will host a page dedicated to the course. All enrolled students should register at
https://piazza.com/stanford/fall2014/cme200me300a/home
The TAs will monitor the board and respond to posted questions in a timely fashion.
Students are encouraged to help the TAs answer the questions of fellow students.

Course schedule

In general, the lectures are scheduled for Monday and Wednesday 11:00-12:15, and the workshops are given on Friday, 11:00-12:15, all in the Gates B1 Auditorium. See the detailed lecture schedule at the end of this syllabus.

Computers and Software

In this course, we will make use of a software package called MATLAB. MATLAB provides a highly interactive development environment and specialized solvers for linear algebra, data analysis, and graphics. If you intend to use your own computer in this course, we recommend you get a MATLAB student version, which can be obtained through the Stanford bookstore or online at www.mathworks.com (you need a copy of your student ID to obtain the student discount online). MATLAB is used in many other courses, so the (limited) expense is worth it. MATLAB is installed on most public computer clusters found on campus.

Textbook and notes

Your class notes and extra handouts are the primary sources for your studies. A detailed set of notes will be available for download from coursework.

The recommended textbook for this course is "Linear Algebra and Its Applications", **fourth** edition, by Gilbert Strang. The textbook can be purchased in the bookstore, and is on reserve in the Engineering library. The lectures do not follow the text in detail, but almost all material covered in the lectures is also discussed in the book.

Class on video and online

The class lectures and workshops are recorded by the Stanford Center for Professional Development (SCPD), and are available online at SCPD's website: http://scpd.stanford.edu. Videos can be accessed at any time during the quarter, and are normally posted soon after the end of a class meeting.

Assessment

Your final grade will be based on assignments, a midterm and a final. We compute your final course grade by weighting assignments, midterm and final grades. Assignments count for 40%, the midterm 20% and the final exam 40%.

All assignments and exams will contain two types of questions. Around 75% of the assignment and exams will be comprised of base questions that you will be able to answer relatively easily if you understand the material given in class. The remaining 25% is comprised of so-called starred (*) questions that are more challenging.

Approximate guidelines for final grades:
Historically, the average score on assignments is 90% or higher, with an occasional tough assignment coming in a bit lower. Historical averages for the midterm and the final exams hoover around 75%. If your scores are average, both for assignments and exams, you likely will receive a B+ in this course. To receive an A you must be able to solve a reasonable number of the starred questions correctly in addition to the base questions. To receive an A+, you must typically have scores in the high 90s on all your exams and assignments.
Final grade assignments are at the discretion of the instructor. If you have any questions about your standing in the class during the quarter, please contact the instructor.

Assignments*:*
There will be eight graded assignments. Assignments 2, 4, 6 and 8 are computational and require MATLAB programming. Assignments 1, 3, 5 and 7 test theoretical knowledge. **Only the six highest scores are recorded.**
Assignments are always handed out on Wednesday and are always due the following Wednesday.
Assignments will be returned to you on Wednesday, a week after the due date.
All deadlines are noted in the lecture calendar below.

We can not accept late assignments because of the size of this class and our strict return-within-one-week policy. Note that because we only count the six highest assignment scores, missing up to two homework assignments due to unforeseen circumstances will not affect your final grade.
Homework grading policies are discussed thoroughly between TAs and instructor to avoid bias. We frequently check statistics of homework grades to check if there are any distinct differences in grading, and will correct for differences if they appear.

Midterm:
The midterm is on Monday October 27 during normal class time. It is closed-book, and will be short to allow ample time for completion. It covers the material of the first 5 weeks (excluding “Iterative Linear Solvers”).

Final exam:
The final exam is on Thursday December 11 from 8:30-11:30. Location will be determined later in the quarter. The final exam is closed-book. The final covers all material.

Lecture schedule

	Date	Topics	Gerritsen Chapters	Strang Sections	Special Session	Assignments
1	09/22	Intro, definitions, Elementary operations	1	1.1, 1.2, 1.4,1.6		
2	09/24	Matrix Inverses, Finite differences, Banded matrices	1	1.7		#1 – Online
	09/26				Workshop 1 Matlab	
3	09/29	Gaussian elimination	2	1.3,1.5		
4	10/01	Gaussian elimination, LU, Pivoting	2	1.3,1.5		#1 – Due #2 – Online
	10/03				Workshop 2	
5	10/06	Ill-conditioning, Condition number	3	1.5, 1.7		
6	10/08	Vector Spaces, Bases	4	2.1,2.3		#2 – Due #3 – Online
	10/10				Workshop 3	
7	10/13	Subspaces, Rank	4	2.1-2.4		
8	10/15	Determinants	6	4.1-4.3		#3 – Due #4 – Online
	10/17				Workshop 4	
9	10/20	Orthogonalization, Gram-Schmidt	5	3.1		
10	10/22	Iterative Linear Solvers	7	7.1-7.4		#4 – Due
	10/24				Workshop 5	
	10/27	Midterm				
11	10/29	Iterative Linear Solvers	7	7.1-7.4		#5 – Online
	10/31				Workshop 6	
12	11/03	Least Squares	8	3.3		
13	11/05	Non-linear Equations	9	3.3		#5 – Due #6 – Online
	11/07				Workshop 7	
14	11/10	Eigenvalues and Eigenvectors	10	5.1-5.6		
15	11/12	Canonical form, Decoupling	10	5.1-5.6		#6 – Due #7 – Online
	11/14				Workshop 8	
16	11/17	Power Method	10	5.5, 7.3		
17	11/19	QR Method	10	7.3		#7 – Due #8 – Online
	11/21				Workshop 9	
	11/24	Thanksgiving Break				
	11/26	Thanksgiving Break				
	11/28	Thanksgiving Break				
	12/01				Workshop 10	
18	12/03	Cayley-Hamilton Theorem, Singular Value Decomposition	10	6.3		#8 – Due
19	12/05	Singular Value Decomposition	10	6.3		
	12/11	Final Exam (all material)				