KOÇ UNIVERSITY

Math 304 (Spring 2012) - Numerical Methods Syllabus

Instructor
Emre Mengi
Science (SCI) 114
Office Hours : Mon 11:00-12:00, Fri 10:00-11:00 (or by appointment)
e-mail : emengi@ku.edu.tr

Teaching Assistant
Mustafa Kılıç
Science (SCI) 111
Office Hours : Thr 17:30-19:00 (or by appointment)
e-mail : mukilic@ku.edu.tr

Lecture Hours and Location
Monday, Wednesday 15:30-16:45 at SCI 103

Text
(1) Lecture Notes from Spring 2010 (will be available at the photocopy room in the student center).
(2) Numerical Analysis, 9th Ed. by Richard L. Burden and J. Douglas Faires (a few copies are available at the bookstore, also will be made available at the reserve desk in the library)

The lectures notes from Spring 2010 also include the assigned homework questions as well as the exams. We will cover fewer topics, but go deeper in a different order as compared to Spring 2010.

The second book by Burden and Faires is a nicely written introductory undergraduate level text. Depending on your background you may find it theoretical or light. The book values the derivation and analysis of numerical algorithms. It provides applications for the numerical algorithms introduced.

The material that will be covered in class is usually based on these two resources. But I will attempt to give my perspective on the topics, so you should not expect a one-to-one match between lectures and these texts.

Supplementary Books
The following are more advanced textbooks in numerical analysis. If you would like to go beyond lectures, take the liberty to gain insight from these books. The first three books will be available at the reserve desk in the library. An electronic copy of the book by Quarteroni, Sacco and Saleri can be accessed through library (visit the website http://libunix.ku.edu.tr/ and search for this book).

- Numerical Linear Algebra by Lloyd N. Trefethen and David Bau
- Fundamentals of Matrix Computations, 2nd Ed by David S. Watkins

- A First Course in the Numerical Analysis of Differential Equations, 2nd Ed by Arieh Iserles
- Numerical Mathematics by Alfio Quarteroni, Riccardo Sacco and Fausto Saleri

Prerequisites

The prerequisite is a passing grade from Math 203 (D or better). Theoretically the course builds on calculus and linear algebra. The basic background material on these topics will be reviewed whenever necessary.

For your convenience two elementary books on linear algebra are listed below.

- Linear Algebra and its Applications, 4th Ed by Gilbert Strang
- Linear Algebra and its Applications, 3rd Ed by David C. Lay

For calculus you can refer to Stewart's book if necessary.

You will be either experimenting with or implementing the numerical algorithms discussed in class in Matlab. You will learn about Matlab during the problem sessions. You can reach a freely available Matlab manual from the website
`http://www.math.mtu.edu/~msgocken/intro/intro.html`

Course Webpage

`http://home.ku.edu.tr/~emengi/teaching/math304/math304.html`

Problem Sessions

The problem sessions will be held weekly on Tuesdays between 17:00-18:15 at ENG B19 and Thursdays 15:30-16:45 at ENG 128. This will give you the best opportunity to practice together with your class-mates and your TA. You will also get used to how to do computing in Matlab during the problem sessions. Attendance will not be taken, but I highly recommend to attend the problem sessions, especially if you are not comfortable with computing. There will be no problem session during the first week.

Grading

Homeworks will be assigned once every two weeks. There will be two midterms and a final. Your overall grade will be determined based on the following scheme.

Total Score = %20 (Homework Score) + %20 (Midterm 1) + %20 (Midterm 2) + %40 (Final) + %10 (Attendance, Bonus)

Midterms

The tentative midterm dates are as follows.

- Midterm 1 - March 14, 2012
- Midterm 2 - April 25, 2012

The precise dates and times will be decided in the class. Both midterms will be closed-book exams. Everything covered in class until the end of the previous week is included in each midterm. Midterms will be held in the evenings, and *not* during the lectures.

Final

All of the topics covered in class throughout the semester are included. Date, time and

location of the final will be announced later towards the end of the semester. The final will be a closed-book exam.

Attendance

Attendance will be taken on random dates. Your attendance score will be determined by the ratio of "the number of times you are present in class on attendance dates" to "the total number of attendance dates". Thus if you are present 6 out of 8 attendance dates, then your attendance score will be $10 \times (6/8) = 7.5$.

Homeworks

The homeworks will normally be assigned once every two weeks. Your homework score will be the average of five or six homeworks. Half of the homework questions will be conceptual. The remaining half will be computational and require performing computations in Matlab.

Description

The course covers various topics in numerical analysis, that are likely to be helpful for your careers. The emphasis will be put on the numerical solutions of linear systems, non-linear systems, integrals and ordinary differential equations. We will also touch on topics such as the least squares problem and interpolation that are commonly used to analyze and approximate large-scale data. We will develop numerical algorithms for these main-stream problems, and analyze their accuracy and efficiency. Convergence of the iterative algorithms, for instance for nonlinear systems, will be discussed. In the homeworks you will apply the numerical algorithms to realistic applications.

Crude Course Calendar

(Weeks 1-2) Locating the Zeros of a Non-linear Equation

(Weeks 3-5) Numerical Solutions of Linear Systems

Midterm 1, March 14 (Covers weeks 1-5)

(Weeks 6-7) Numerical Solutions of Nonlinear Systems of Equations

(Week 8) Polynomial Interpolation

(Week 9) Approximation Theory - Least Squares Problem and Orthogonal Polynomials

(Weeks 10-11) Numerical Integration

Midterm 2, April 25 (Covers weeks 1-10)

(Weeks 12-14) Numerical Solutions of Ordinary Differential Equations

Important Enrollment Dates

- February 6, Monday — First Day of Classes
- February 8-10 — Add-Drop Period
- March 30, Friday — Deadline to Withdraw
- April 9-13 — Spring Break
- April 23, Monday — National Sovereignty and Children's Day
- May 1, Tuesday — Labor and Solidarity Day
- May 18, Friday — Last Day of Classes