Math 305 (Fall 2020) - Numerical Analysis Syllabus

Description
It may not be possible to express solutions of various problems in your mathematics courses in analytical terms. But that does not refrain us from finding numerical solutions, approximate yet highly accurate solutions satisfying prescribed error. For instance such is the case with finding the roots of a function, or the eigenvalues of a matrix, integrating an integrable function. The course touches on such subjects. It introduces fundamental tools in numerical analysis with detail and rigor.

Instructor
Emre Mengi
Science (SCI) 113
Office Hours : Thursday 16:30-17:20 (to be held remotely once a week or upon request)
e-mail : emengi@ku.edu.tr

Teaching Assistant
To be announced.

Lecture Hours
Tuesday, Thursday & Friday 13:00 - 13:50
All lectures will be held remotely and synchronously (during the regular lecture hours). Recorded videos of the lectures will also be available on blackboard.

Course Webpage
http://home.ku.edu.tr/~emengi/teaching/math305/math305.html
Note that most of the course material will be posted on blackboard.

Textbook
An Introduction to Numerical Analysis by Endre Suli and David Mayers

An electronic copy can be accessed through library's webpage, in particular from the following website:
http://0-search.ebscohost.com.libunix.ku.edu.tr/login.aspx?direct=true&scope=site&db=nlebk&AN=125081

Supplementary Books
– Numerical Methods, Anne Greenbaum and Timothy Chartier
– A First Course in Numerical Methods, Uri Ascher and Chen Greif

Purposes
– Numerical solutions of nonlinear equations and systems of nonlinear equations
– Direct and numerically stable solutions of linear systems
– Numerical computation of eigenvalues
– Functional approximation theory, approximations in the 2- and ∞-norms
– Polynomial interpolation
– Calculating integrals numerically

Grading

$$\text{Total Score} \quad = \quad \%60 \text{ (Homeworks)} + \%40 \text{ (Final)}$$

You will be given at least one day to complete the final and return your solutions.

Homeworks
There will be 5-7 homeworks assigned throughout the semester. In each of the homeworks, majority of the problems will be conceptual, but there will also be a few computational problems. You will be using Matlab for solving computational problems. For each homework, you will have about two weeks to complete it.

Interactions in the Lectures and Office Hours
The lectures will be held live through "zoom" during the regular lecture hours. Additionally, I will be holding a remote office hour every week.

I would highly recommend that you attend the live lectures regularly (even though attendance will not be taken), as this would give you the opportunity to interact while learning a subject. You are encouraged to ask questions during the lectures at any time through zoom; this can facilitate your learning during the lecture hours.

Participating in the office hours should have a different purpose. Sometimes, I may solve a few exercise questions related to the topics of the week during the office hours. Additionally, if you could study the topics of the week and solve problems on your own, office hours give you the opportunity to ask questions about the topics and problems that you are having difficulty with.

Important Enrollment Dates

- October 5, Monday : First Day of Classes
- October 5-9 : Add-Drop Period
- October 29, Thursday : Foundation of Turkish Republic
- January 8th, Friday : Last Day of Classes
- January 11 - January 20 : Final Period

Course Calendar

This calendar is tentative. The precise duration on various topics are likely to change. The numbers inside the parentheses refer to the sections of the textbook.

– Week 1 (Oct 5): Solution of equations by iterations (1.1 - 1.8)
– Weeks 2-3 (Oct 12): Solution of systems of linear equations (2.1 - 2.6, 2.7, 2.9)
– Week 4 (Oct 26): Symmetric and banded matrices (3.1 - 3.3)
– Week 5 (Nov 2): Simultaneous nonlinear equations (4.1 - 4.4)
– Weeks 6-7 (Nov 9): Eigenvalues, eigenvectors of a symmetric matrix (5.1 - 5.10)
– Week 8-9 (Nov 23): Polynomial interpolation (6.1 - 6.5)
– Week 10 (Dec 7): Numerical integration, Newton-Cotes quadrature (7.1 - 7.7)
– Week 11 (Dec 14): Polynomial approximation in the ∞-norm (8.1 - 8.5)
– Week 12 (Dec 21): Approximation in the 2-norm (9.1 - 9.4)
– Week 13 (Dec 28): Numerical integration, Gaussian quadrature (10.1 - 10.6)
– Week 14 (Jan 4): Review
– Optional topic (If time permits): Initial value problems for ODEs (12.1 - 12.5)