TED UNIVERSITY

MATH 210
Numerical Methods in Engineering

SYLLABUS/Fall 2023

Course Information

Required or Elective	☑Required ☐Elective	**Date Prepared**	September 2023
Semester	Fall 2023	**Class Hours and Classrooms**	Tue 17:00-18:50, F206 Thu 16:00-17:50, G205
Course Credit Hours/ ECTS credits	(0+0+4) 2 / 4	**Pre-requisite/ Co-requisite**	MATH 101 / MATH 203
Level of Course	Sophomore	**Language of Instruction**	☑ English ☐ Turkish
Instructors and their office hours	Assoc. Prof. Dr. Rıza Secer Orkun Keskin, E-mail: secer.keskin@tedu.edu.tr; Room: D313 Office Hour: Please get an appointment by e-mail.		
Teaching Assistant(s)	Ömer Can Pamuk E-mail: omer.pamuk@tedu.edu.tr		
Textbook	Chapra, S.C. and Canale, R.P. (2015) Numerical Methods for Engineers, 7th Edition, McGraw-Hill Education.		
Recommended Readings	1. An Engineer's Guide to MATLAB : with Applications from Mechanical, Aerospace, Electrical, Civil, and Biological Systems Engineering by Magrab, Prentice-Hall, 3rd Edition, 2011. 2. Numerical Methods using MATLAB by Mathews, 4th Edition, Pearson, 2010.		
Course Web Pages	Please follow the course web page on https://lms.tedu.edu.tr regularly to have access to the posted course materials and announcements.		

Course Description

Numerical solution techniques for mathematical problems in engineering. Computer programming for solution of engineering problems. Numerical root finding. Numerical linear algebra. Numerical integration and differentiation. Solution techniques for ordinary differential equations.

Course Learning Outcomes

Upon successful completion of this course, students will be able to:

1. use a software package such as MathWorks MATLAB and basic programming techniques to solve engineering problems [B3, B5],
2. evaluate iterative solution concepts, sensitivity, reliability and convergence of numerical solutions [B5],
3. select an appropriate numerical technique for a given problem type and apply it to solve a range of engineering problems; root finding, curve fitting, differentiation and integration, solution of ordinary differential equations and linear algebraic equations [B3, B5, B6].

Course Assignments

A. *MATLAB Academy (5%):* Two courses from MATLAB Academy (MATLAB Onramp and MATLAB Fundamentals) will be asked to complete.
B. *Homework Assignments with MATLAB (10%):* A number of homework assignments with MATLAB will be given.
C. *Quizzes/Homework Assignments (10%):* A number of quizzes and homework assignments will be given.
D. *Midterm exams (25%+25%):* Two mid-term exams will be given.
E. *Final Exam (25%):* There will be a cumulative final exam.

Course Assessments & Learning Outcomes Matrix

Assessment Methods	Course Learning Outcomes
Laboratory	all
Homework Assignments	#2, #3
Midterm Exams	#2, #3
Final Exam	all

Extended Description

Engineering problems have become more and more complex and computers are the main tool for engineering computations. Most of such problems require one or more of the following numerical techniques: root finding, interpolation/extrapolation, solution of linear algebra problems, differentiation and integration, solution of ordinary differential equations etc. This course provides the students the basic skills for solving engineering problems with computers, where approximate answers are simpler/quicker/more readily available/useful than precise/exact mathematical/analytical solutions. The course starts with basic concepts of scientific and engineering computations. Finding of roots of the equations, interpolation/extrapolation, computerized solution of series of linear equations, numerical differentiation and integration, and solution of ordinary differential equations are the main topics. Practice hours and assignments involve application of knowledge gained in lectures through hands-on computer programming using MATLAB as the main numerical calculation environment.

Tentative Course Outline

A tentative course outline for the lectures is given below. Any changes and updates will be announced on the Moodle web page for the course.

Week	Topics
1	- Introduction to Numerical Modeling - Approximations and Round-off Errors - Truncation Errors and Taylor Series
2	- Numerical Root Finding - Graphical Method - Bracketing Methods - Bisection Method - False Position Method
3	- Open Methods - Simple Fixed Point Iteration - Two Point Iteration - Newton Raphson Method - Secant Method
4	- Curve Fitting - Least Squares Regression
5	- Interpolation - Linear Interpolation - Quadratic Interpolation - Lagrange Interpolating
6	- Numerical Integration and Differentiation - Numerical Integration - The Trapezoidal Rule - Multistep Trapezoidal Rule 1/3 Simpson's Rule - Multistep 1/3 Simpson's **Midterm Exam #1**
7	- Romberg Integration - Gauss Quadrature
8	- Numerical Differentiation - Forward Finite Difference Technique - Backward Finite Difference Technique - Central Finite Difference Technique
9	- Solution of Ordinary Differential Equations - Runge-Kutta Methods - Euler's Method - Heun's Method - Midpoint Method
10	2nd Order RK Methods 3rd Order RK Method 4th Order RK Method
11	- Solution of Linear Algebraic Equations - Graphical Method - Gauss Elimination Technique

12	○ Gauss-Jordan Technique ○ Gauss-Seidel Technique ○ LU Decomposition Method **Midterm Exam #2**
13	MATLAB Programming
14	MATLAB Programming

Course Policies and Some Remarks

Attendance

Attendance is strongly recommended. To be admitted to the final exam, a student **must submit at least 80% of the given assignments and take the mid-term exams**. Students who are not given the permission to take the final exam will automatically receive the grade FX at the end of the semester.

Calculator Policy

You may use a scientific calculator during the exams. Programming the calculator before or during the exams are not allowed.

Make Up Exams

Make-up exams for midterm exams will NOT be offered. The only exceptions are illness or emergency (e.g., death in family, a traffic accident, etc.). In case of an illness or emergency you need to supply a documentation that supports your claim. Also please read the document given in the link http://www.tedu.edu.tr/tr/main/yonetmelikler-ve-yonergeler

Plagiarism

Collaboration on non-collected homework and in studying is strongly encouraged; however, the work you hand in must be solely your own. Sharing written work before it is turned in to be graded is academic dishonesty. For more information on TEDU policy on intellectual integrity see the TEDU student handbook (https://student.tedu.edu.tr/en/student/principles-of-academic-integrity).

TEDU Without Barriers Unit

Please inform the TEDU Without Barriers Unit and the instructor of the course about the specific issues in case you have a physical or mental disability and are having trouble with anything related to this course—such as accessing the material, participating in the class, taking notes, preparing for, attending or managing to complete the exams. Your situation will be reviewed by commission, in accordance with the principle of confidentiality, and if deemed appropriate, facilitating measures will be taken so that you can take the course more efficiently.

For further information and/or questions:

engelsiz@tedu.edu.tr, https://www.tedu.edu.tr/engelsiz-tedu

Student Development and Psychological Counseling Center

Student Development and Psychological Counseling Centre is mandated with providing crisis intervention and supportive listening services to the campus community. The Center conducts individual counseling, group guidance studies, workshops, seminars, and orientation studies for all students in need. You may apply to the Center in order to deal with all your current problems.

For further information and/or questions:

ogrencidanismamerkezi@tedu.edu.tr, http://csc.tedu.edu.tr/