MAT434 - MATHEMATICAL SOFTWARE II - Fen Edebiyat Fakültesi - Matematik Bölümü

General Info

Objectives of the Course

The objective of this course is to equip students with the skills to solve mathematical and engineering problems using the MATLAB programming environment. The course covers fundamental concepts such as vectors, matrices, systems of linear equations, polynomials, plotting, symbolic and numerical computations, differential equations, and mathematical modeling. Students will learn to develop algorithms using MATLAB's basic programming structures and functions, and to model real-world problems effectively.

Course Contents

1. Arrays (Vectors and Matrices) 2. Systems of Linear Equations 3. Polynomials 4. Plots (2D and 3D) 5. Programming in MATLAB 6. Symbolic Operations (Integration, Differentiation, Solving Algebraic Equations) 7. Numerical Operations (Root Finding, Numerical Integration) 8. Differential Equations 9. Numerical Methods 10. Mathematical Modeling 11. Finding Roots of Nonlinear Algebraic Equations 12. Linear Equation Systems 13. Numerical Differentiation and Numerical Integration

Recommended or Required Reading

Matlab ile Nümerik Analiz, Selahattin Gültekin

Planned Learning Activities and Teaching Methods

Lectures (Theoretical Instruction): Topics are presented by the instructor using board or digital tools. Question and Answer Sessions: Students are encouraged to actively participate and receive immediate feedback. Practical Exercises: Example problems related to the subject are solved interactively with the students. Computer-Assisted Applications: Numerical methods and graphical solutions are implemented using software such as MATLAB. Homework and Project Assignments: Students are required to complete individual or group-based assignments on selected topics. Student Presentations: Students share their understanding by presenting on specific topics during the semester. Regular Quizzes and Feedback: Short quizzes are administered to ensure continuous learning and retention.

Recommended Optional Programme Components

A basic understanding of mathematics and differential equations is essential for efficient learning. Familiarity with software tools used in the course (e.g., MATLAB) enhances students' ability to engage in applied activities. Pre-reading of the related topics is recommended for active classroom participation. Following related studies in the scientific literature is encouraged. Reinforcement of topics through group work and individual research is supported. Students are expected to adhere to academic ethics and integrity principles.

Instructor's Assistants

There is no instructor's assistants teaching the course.

Presentation Of Course

The course is conducted through face-to-face instruction as part of formal education. Theoretical lectures and practical examples are delivered in the classroom environment. Computer-aided software applications, problem-solving sessions, and interactive discussions are employed to promote active learning. When necessary, the course is supplemented with online materials.

Dersi Veren Öğretim Elemanları

Assoc. Prof. Dr. Mehmet Şenol

Program Outcomes

1. Can perform operations with vectors and matrices in MATLAB.
2. Can solve systems of linear equations using MATLAB.
3. Can perform polynomial operations such as multiplication, differentiation, and root finding.
4. Can create and interpret 2D and 3D plots for data visualization.
5. Can develop algorithms using basic programming constructs in MATLAB (loops, conditionals, functions).
6. Can carry out symbolic computations such as differentiation, integration, and solving algebraic equations.
7. Can apply numerical methods for root finding and numerical integration.
8. Can solve differential equations both symbolically and numerically.
9. Can implement basic numerical methods (e.g., Euler, Runge-Kutta) for computational solutions.
10. Can find the roots of nonlinear algebraic equations using numerical techniques.
11. Can apply numerical differentiation and integration techniques for function analysis.

Weekly Contents

Order	PreparationInfo	Laboratory	TeachingMethods	Theoretical	Practise

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1	Students taking this course are expected to have a basic understanding of mathematics (vectors, matrices, functions, and basic algebraic operations) and general computer literacy. Prior programming experience is recommended but not required. Logical thinking and the ability to develop algorithmic solutions are essential for effectively benefiting from the course.		Lecture (Theoretical Instruction): Concepts and syntax for vectors and matrices in MATLAB are explained in detail. Demonstration: Step-by-step examples of vector and matrix operations are demonstrated using MATLAB interface. Computer-Based Practice: Students perform exercises and sample problems on their own computers. Interactive Q&A: The instructor engages students through questions and answers during the session. Problem Solving: Applications related to real-world problems or engineering contexts involving vectors and matrices are solved. Short Quiz and Feedback: Students are given short quizzes or exercises at the end of the topic to assess learning progress.	Vector and matrix definitions in MATLAB environment.	Vector and matrix definitions in MATLAB environment.
2	Students taking this course are expected to have a basic understanding of mathematics (vectors, matrices, functions, and basic algebraic operations) and general computer literacy. Prior programming experience is recommended but not required. Logical thinking and the ability to develop algorithmic solutions are essential for effectively benefiting from the course.		Lecture (Theoretical Instruction): Concepts and syntax for vectors and matrices in MATLAB are explained in detail. Demonstration: Step-by-step examples of vector and matrix operations are demonstrated using MATLAB interface. Computer-Based Practice: Students perform exercises and sample problems on their own computers. Interactive Q&A: The instructor engages students through questions and answers during the session. Problem Solving: Applications related to real-world problems or engineering contexts involving vectors and matrices are solved. Short Quiz and Feedback: Students are given short quizzes or exercises at the end of the topic to assess learning progress.	Solving systems of linear equations with MATLAB.	Solving systems of linear equations with MATLAB.
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Workload

Activities	Number	PLEASE SELECT TWO DISTINCT LANGUAGES
Vize	1	1,00
Derse Katılım	14	4,00
Ödev	4	3,00
Ders Öncesi Bireysel Çalışma	14	2,00
Ders Sonrası Bireysel Çalışma	14	2,00
Ara Sınav Hazırlık	2	4,00
Final Sınavı Hazırlık	1	1,00
Teorik Ders Anlatım	4	4,00
Problem Çözme	4	4,00

Assesments

Activities	Weight (%)
Ara Sınav	40,00
Final	60,00

Matematik Bölümü / MATEMATİK X Learning Outcome Relation

	P.O. 1	P.O. 2	P.O. 3	P.O. 4	P.O. 5	P.O. 6	P.O. 7	P.O. 8	P.O. 9	P.O. 10	P.O. 11
L.O. 1											
L.O. 2											
L.O. 3											
L.O. 4											
L.O. 5											
L.O. 6											
L.O. 7											
L.O. 8											
L.O. 9											
L.O. 10											
L.O. 11											

Table :

P.O. 1 : Matematiğin temel alanlarından Analiz, Geometri ve Cebirin temel kavramlarını bilimsel yöntem ve teknikler yardımıyla tanımlar.

P.O. 2 : Matematiksel verileri yorumlar, çözümler, güvenirliliğini ve geçerliliğini değerlendirir.

P.O. 3 : Günlük hayattaki bazı problemlerin Matematiksel modellerini tanımlar, eleştirel bir açı ile değerlendirir, teorik ve uygulamalı bilgilerle analiz eder.

P.O. 4 : Öğrenme süreçlerinde disiplinler arası yaklaşımı analitik olarak kullanır.

P.O. 5 : Matematik alanındaki bir konuya uygun materyal geliştirir; bilgi ve tecrübe kazanımlarını farklı yöntemlerle kullanır.

P.O. 6 : Kendini bir birey olarak tanır; yaratıcı ve güçlü yönlerini kullanır, kişisel ve kurumsal iletişim ve etkileşim kurar.

P.O. 7 : Alanıyla ilgili öğrenme ihtiyaçlarını belirler. Alanının gerektirdiği düzeyde bilgisayar yazılımı ile birlikte bilişim ve iletişim teknolojilerini ileri düzeyde etkileşimli olarak kullanır.

P.O. 8 : Yaşam boyu öğrenme ve kalite yönetim süreçlerini öğrenir ve uygular; alanındaki sosyal, kültürel ve sanatsal etkinliklere katılır.

P.O. 9 : Toplumsal sorumluluk bilinciyle mesleki proje ve etkinlikler planlar ve uygular.

P.O. 10 : Matematik temel alanının gerektirdiği yabancı dili Avrupa Dil Portföyü B1 Genel düzeyinde kullanarak sözlü ve yazılı iletişim kurar.

P.O. 11 : Kazanacağı bilgi birikimi ile sorumluluğu altında çalışanların öğrenme gereksinimlerini belirler, lisansüstü eğitimin gereklerini yerine getirir.

L.O. 1 : MATLAB ortamında vektör ve matrislerle işlem yapabilir.

L.O. 2 : Doğrusal denklem sistemlerini MATLAB kullanarak çözebilir.

L.O. 3 : Polinomlarla ilgili işlemleri (çarpım, türev, kök bulma vb.) gerçekleştirebilir.

L.O. 4 : İki ve üç boyutlu grafikler oluşturabilir ve görselleştirme tekniklerini uygulayabilir.

L.O. 5 : MATLAB'te temel programlama yapıları (döngüler, koşullar, fonksiyonlar) kullanarak algoritmalar geliştirebilir.

L.O. 6 : Simgesel matematik işlemleri (türev, integral, cebirsel denklem çözümü) yapabilir.

L.O. 7 : Sayısal kök bulma ve nümerik integrasyon yöntemlerini uygulayabilir.

L.O. 8 : Diferansiyel denklemleri hem simgesel hem sayısal olarak çözebilir.

L.O. 9 : Temel nümerik yöntemleri (örneğin Euler, Runge-Kutta) kullanarak çözümler üretebilir.

L.O. 10 : Lineer olmayan cebirsel denklemlerin köklerini sayısal yöntemlerle bulabilir.

L.O. 11 : Nümerik türev ve integrasyon tekniklerini kullanarak fonksiyon analizleri gerçekleştirebilir.